RAILROAD GAZETTE

SATURDAY, MAY 30, 1874.

THE CATECHISM OF THE LOCOMOTIVE.

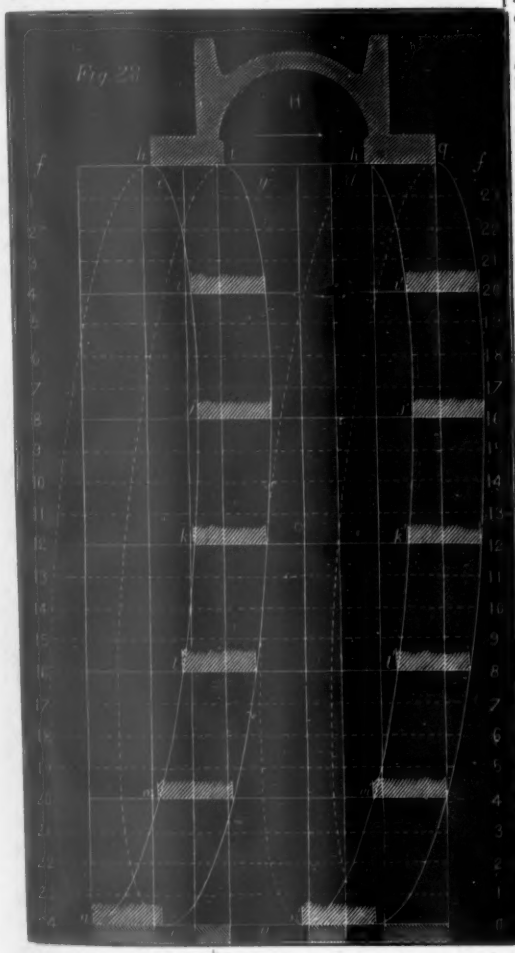
BY M. N. FORNEY, *Mechanical Engineer.*

PART X—(CONTINUED).

THE VALVE GEAR.

QUESTION 188. *Can the position of each edge of the valve, with any given amount of travel, be shown in its relation to the ports by one motion-curve, or is it necessary to draw such curves for each edge of the valve, as shown in fig.* 28?

Answer. One motion-curve is sufficient to represent the position of any part of the valve during the entire stroke. This will be apparent if it is remembered that each motion-curve is exactly like the others, as shown in fig. 28, the only difference being that the ports occupy different positions in relation to the curves. It is, therefore, only necessary to draw lines to represent the relative position of the ports to the other curves to show the entire motion of the valve by one curve. To illustrate this it will be assumed that a motion-curve, *h, i, j, k, l, m, n, o, p,* and a center line*, *a, b,* fig. 127, have been drawn with the instrument described in the answer to the previous question. The center line, *a, b,* which will be equal in length



to the stroke of the piston, should then be divided into inches, and lines 24, 0, —23, 1, —22, 2, etc., should be drawn through the points of division and at right angles to *a, b.* If, now, we want to show the movement of the front steam edge of the valve in relation to the corresponding steam port, a line, *t,* fig. 128, should be drawn perpendicular to 24, 0, to represent that edge of the valve at the beginning of the stroke. As it is impossible to determine accurately the position of this steam edge at the beginning of the stroke from the motion-curve, which is then *tangent*† to the line 24, 0, we must lay it off from the center line, *a b.* This can readily be done if we remember that if a valve has 7/8 in. lap when it is in the middle position, as shown in fig. 27, and 1-16 in. lead at the beginning of the stroke, it must have moved 15-16 in. from the middle position at the beginning of the stroke as shown in fig. 28. The line *t* must therefore be drawn 15-16 in. from *a b* to represent its proper position in relation to the motion-curve, and as it has 1-16 in. lead, the steam edge, *h h',* of the steam-port must be drawn at that distance from *t.* Another line, *m m',* can then be drawn to represent the width of the front steam-port, *c c'.* From these lines the movement of the valve in relation to the front port, *c c',* and the admission of steam are shown as clearly as in fig. 28.

If now we want to represent the motion and relative position of the back steam edge of the valve in relation to its port, it is only necessary to assume that the line *t* represents that edge, and that the curve *h i j k l m n o h* represents its motion, and to draw the back steam-port in its proper relation to it. When the valve is in its middle position, as shown in fig. 27, the outside edge of the port *h* is 7/8 in., or a distance equal to the lap, from the steam edge *q* of the valve. As the center

line *a b,* fig. 127, represents the middle position of the edge of the valve, it is only necessary to draw a line, *n n',* 7/8 in., or the same distance from the center line *a b* that the outer edge of the port *d* is from *q* in fig. 28, to represent this edge of the port in fig. 127, and another, *h h',* at a distance from the former equal to the width of the port, to represent its inner edge. A line, *q,* below the line 0 24, will represent the edge of the valve at the beginning of the forward stroke. The curves in relation to the port *d* will then show the motion of the valve in relation to this port, in the same way that the curve *q d* does in fig. 28.

If it is desired to represent the motion of the exhaust edge *h',* fig. 28, of the valve, it is only necessary to imagine that the line *t,* fig. 127, represents that edge, and then draw in the port *d* in the same relation to it that it bears to the edge *h',* in fig. 28. This has been done in dotted lines, *c c'* and *e e',* in fig. 127.

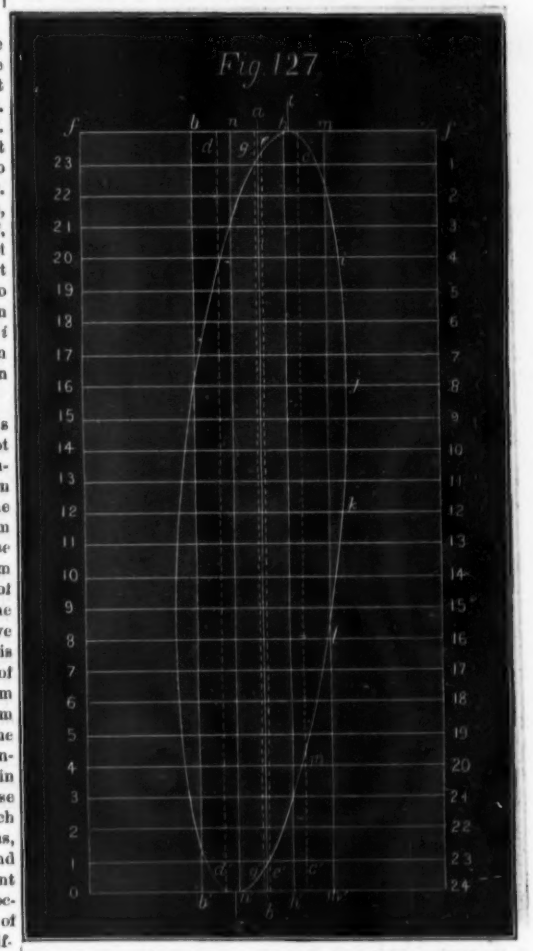
If the reader will cut a paper section of a valve like that shown in fig. 28 and place the different edges, *h, i, h'* and *q,* so that they will successively correspond with the line *t* in fig. 127, the diagram will perhaps be more clear. If, for example, the paper section be placed to the right of the line *t,* so that the edge *h* will correspond with *t,* then it will be seen that the port *c* occupies the same relation to it that it does in fig. 28. If the valve be placed to the left, so that the edge *q* corresponds with *t,* then the port *d* will be in the same relation to it that it has in fig. 28. If the edges *i* and *q* be made to correspond with *t,* then the ports drawn in dotted lines in fig. 127 will represent the ports *c* and *d* in fig. 28.

It is also quite easy to determine the position of the ports in relation to the center line of the motion-curve, if it is kept in mind that the center line *a b,* fig. 127, represents the position of the different edges of the valve when the latter is in the middle of the valve-face, as shown in fig. 27, and that the ports must be on the same side, and the same distance from the center-line that they are from the edge of the valve whose motion is represented. Thus if the movement of the steam edge *h* in relation to its port, *c,* was represented, the edge of the latter must be drawn on the motion diagram the same distance from the center-line that it is from *h* when the valve is in its middle position as shown in fig. 27. This distance is of course just equal to the lap of the valve. If the motion of the exhaust edge *h'* was represented in relation to the steam port *d,* then the latter would be drawn the same distance from the center-line *a b* in the diagram that the inner edge of the port is from the edge *h'* of the valve, which is equal to the inside lap. The exhaust port could also be drawn in the same way, but it would be liable to confuse a diagram made to so small a scale as that which has been employed for the accompanying illustrations, and it has therefore been omitted. Diagrams of this kind which are made full size will, of course, show the movement of the valve more distinctly than is possible in the space occupied by the illustrations herewith. When they are made of full size, the lines indicating the ports should be drawn of different colors, so as to distinguish them from each other easily. Such diagrams will show the position of the valve in relation to the ports, and indicate the distribution of the steam during the whole stroke. It is only necessary to refer the curve to the proper line to determine the position of the valve in relation to either of the ports for either the admission or the release of the steam. If, for example, we want to observe how the admission of steam is governed by the valve, by referring to fig. 127 we see that at the beginning of the backward stroke the valve has 1-16 inch lead; that at 2 inches of the stroke the port *c* is wide open, as shown by the intersection of the motion-curve with the line *m, m';* that the valve has received its maximum backward travel at 9 inches of the stroke, and begins to close the port at 15⅛ inches, and completely closes it at 21 inches of the stroke. By referring the motion-curve to the lines *nn'* and *bb',* we see that the valve again has 1-16 inch lead at the beginning of the forward stroke; that the steam port is wide open at 2⅜ inches of the stroke; begins to close at 16 inches, and is completely closed at 21 inches. By referring the curve to the lines *ee'* and *cc',* we see that the front port begins to open before the piston has completed its forward stroke and when it has nearly an inch to move; that it is wide open almost immediately after the piston begins its stroke, does not begin to close until the piston has moved 19⅛ inches of its stroke, and is completely closed at 23 inches of the stroke. By referring the curve to the lines *dd'* and *gg',* almost the same phenomena will be observed for the forward stroke. In fact, from such a diagram the whole motion of the valve can be studied and analyzed with the greatest accuracy; and, as has already been shown, the motion imparted to a slide-valve by a link is of so complicated a nature that it is almost or quite impossible to observe its exact nature without such diagrams.

QUESTION 189.—*Can a motion diagram be constructed to represent the motion of the valve with different amounts of travel?*

Answer.—Yes; it is only necessary to construct motion-curves for the same diagram for each distance traveled, and they will show the movement of the valve for the given amount of travel represented by the curves. This has been done in fig. 128, which is a reduced copy of a series of motion curves taken from a locomotive. From this diagram the movement of a slide-valve worked by the link-motion can be seen from the highest to the lowest practicable point of cut-off. For convenience of reference the curves have been numbered.

The smallest travel of the valve represented by curve No. 1 is a little less than 2¼ in., and the ports are then opened only about 5-16 inc., and the steam is cut off at 8 in. on the backward and 6¾ in. on the forward stroke. The exhaust is opened or the steam is released during the backward stroke at 17 in., and during the forward stroke at 16⅝. When the valve works with its greatest travel, as represented by curve 8, it travels 5 in., and opens the steam port wide at 3 in. of the backward stroke and 2¼ inches of the forward stroke. The steam is cut off a 20¾ and 20⅛ in., and its release takes place at 23 ⅛ in. of each stroke. The following table gives the greatest width of opening, the point of cut-off, the point of release, and the lead for each motion-curve on the diagram. This table has been made up from the motion-curves drawn with the instrument described in answer to Question 187, on a locomotive which had been running about eighteen months and whose valve-gear consequently was



considerably worn, as is indicated by the flatness of the motion-curves on each side at the point when the motion of the valve was reversed. This flatness was caused by the lost

No. of curve...	Travel of valve.	Width of opening of steam-port.		Point of cut-off.		Point of release.		Lead.....
		Backward stroke.	Forward stroke.	Backward stroke.	Forward stroke.	Backward stroke.	Forward stroke.	
	in.	in.	in.	in.	in.	in.	in.	in.
1	2¼	11-32	5-16	7⅝	6¾	17	16⅝	9-32
2	2⅝	7-16	13-32	9½	9½	18⅝	18 5-16	½
3	2⅞	9-16	½	12	11¾	19⅝	19 9-16	7-32
4	3⅜	11-16	41-64	14	14	20 11-16	20 9-16	3-16
5	3½	⅞	27-32	16½	16½	21 11-16	21½	5-32
6	4	1⅛	1 3-32	18⅛	18⅛	22⅝	22⅛	⅛
7	4½	1⅜	1⅜	19⅝	19½	23 13-16	22⅝	3-32
8	5	1⅜	1⅜	20⅝	20⅛	23¾	23⅛	1-16

motion in the valve-gear, the pencil remaining for a time stationary when the motion was reversed and while the parts were moving from their bearings on one side to those on the other. The curves and the table therefore show the operation not of a theoretically perfect valve-gear, but are examples of actual practice, with such imperfections as are incidental to ordinary locomotives. It will be seen that the instrument shows not only what the valve-gear should, but what it actually does do, and delineates all the imperfections of the valve-gear.

QUESTION 190. *What are the chief dimensions of the valve-gear represented in fig.* 128?

Answer. The throw of the eccentrics was 5 in., the steam-

* In drawing such curves a center line, *a, b,* should always be drawn, otherwise there are no definite points or lines to work from. Such a line can easily be described by moving the engine or model (if the latter is employed) until the valve is in the middle position. A nut or set-screw should be attached to the shaft *F,* fig. 126, which carries the bell-crank, *E, F, G,* so that by screwing up this nut the shaft can be so fastened that the pencil will stand in the middle of the travel, if the upper arm, *G,* of the bell-crank is disconnected from the valve-stem or rocker. The center line can then readily be drawn by moving the piston one stroke with the pencil in contact with the paper.

† A curve is said to be *tangent* to another curve or straight line when the two just touch, but do not intersect or cross each other.

ports were 1¼ in., the exhaust-port 2⅜ in., the valve had ⅞ in. outside and 1-16th inside lap and 1-16th in. lead at full stroke.

QUESTION 191. *What relation is there between the distance which the ports are opened by the valve, and its travel when worked by a link?*

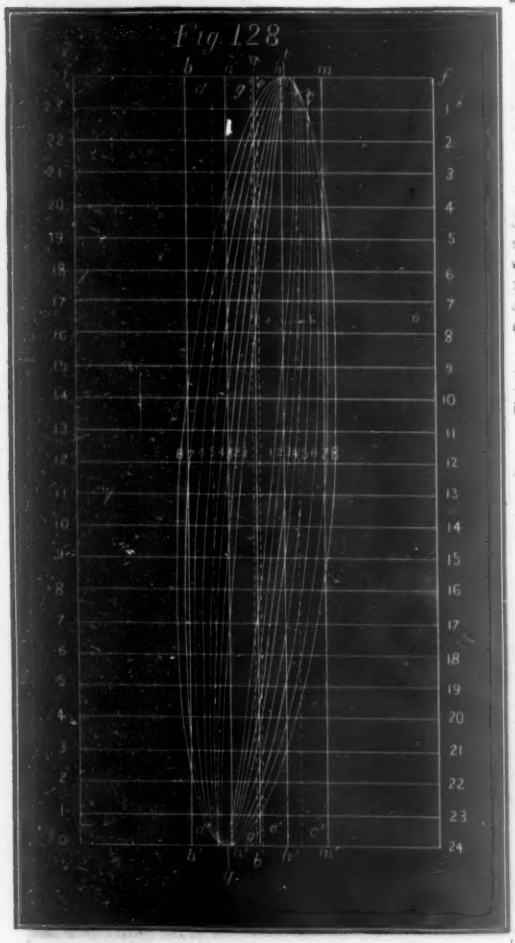
Answer. As explained in the answer to Question 51, the width which the steam ports are opened by the valve for the admission of steam diminishes with the travel of the valve. This is shown very clearly by the motion-curves, and also in the above table, from both of which it will be seen that when the valve travels only 2¼ in. the steam ports are opened only 11-32 in. for the back stroke and 5-16 for the front. With 2⅝ travel the opening is 7-16 and 13-32 in. With 4 in. travel the port is opened 1⅝ and 1 3-32 in., and with 4¼ in. travel they would be opened wide. With 4¼ and 5 in. travel, as will be seen from the motion diagram, the ports are not only opened wide but the valve "throws over" them, or travels beyond their inner edges.

QUESTION 192. *How is the point of cut-off affected by the link?*

Answer. Changing the travel of a valve with a link has a very similar effect to that produced by eccentrics of different throw—that is, the period of admission is increased with the throw of the eccentric and that for expansion lessened. This is shown clearly in both the motion diagram and the table. With the first curve and a travel of 2¼ in. the steam is cut off at 7¾ in. for the backward stroke and 6¾ in. for the front, and with 5 in. travel steam is admitted during 20⅝ in. of the backward and 20¼ in. of the forward stroke.

QUESTION 193. *How is the point of release or exhaust of the steam affected by the link?*

Answer. As the travel increases, it is delayed until later



in the stroke. Thus with 2¼ in. travel the steam is exhausted or released from the cylinder during the backward stroke when the piston has moved 17 in., and on the return stroke at 16⅝ in., whereas with 5 in. travel of the valve, the release is delayed until 25⅝ in. of the stroke. An examination of the diagram and table will show very clearly the relation of the point of release to the travel.

QUESTION 194. *How is the lead affected by the ordinary link motion?*

Answer. It is increased as the travel is diminished, as is shown in the table, and also by the inclination of curves at the top and bottom of the diagram.

QUESTION 195. *What is the cause of this change of the amount of lead?*

Answer. This can be best explained by reference to fig. 129, which represents a link with very short eccentric rods. If now the center from which the link was drawn was in the center of the axle *S*, and the eccentric straps embraced the axle instead of the eccentrics, their ends *c* and *d* would each describe the same arc, *a*, *b*, parallel with the center line *x*, *y*, of the link, and it could then obviously be raised and lowered without moving the rocker-pin at all. But the eccentric straps being attached to the eccentrics, as shown by the dotted lines, when the upper rods are raised or lowered they describe arcs, *c*, *e*, and *g*, *h*, from the centers *s* and *t* of the eccentrics, and not from the center of the axle. When the link is raised then, the end of the upper rod obviously moves in the arc *c*, *e*, and the top of the link is moved from the axle, as shown in fig. 130, a distance equal to the interval between the arc *a*, *b*, drawn from the center of the axle, and *e*, *f*, which the rod describes from the center of its eccentric. When the link is lowered from back to mid gear, a similar action takes place, as the end *d*, fig. 130, of the lower rod describes an arc, *f*, *g*, so that the whole link is thrown from the axle a distance equal to the space between the arcs described from the center of the axle and the centers of the eccentrics. When the position of the eccentrics is reversed, as shown in fig. 131, the link is moved towards the axle, thus causing an increase of lead on the opposite side of the valve. We have employed for our illustrations very short eccentric rods, in order to make this action apparent by exaggerating it. It is obvious from the engravings that the difference in the lead is increased as the eccentric rods are shortened and also as the distance between the points of connection of the rods with the link is increased.

Contributions.

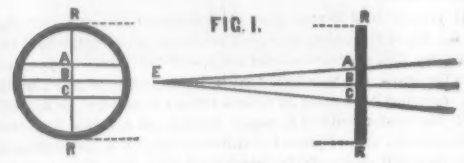
A Suggestion to Levelers.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Every one who has used a leveling instrument for any considerable length of time must have been often vexed at not being able to take a turning point quite as high or as low as he desired, or at not being able to take readings over a knoll, the top of which was a little higher than the instrument.

A slight modification of the reticle of the instrument will give considerable latitude for taking turning points which are either too high or too low to be taken with the instrument as ordinarily arranged.

Instead of one horizontal line in the reticle, as is usually the case, let there be three, arranged as in fig. 1—one above and another below the center.

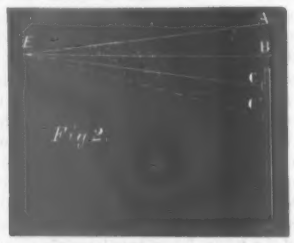


It is evident that this will enable the operator to take three different readings on the rod while it is held stationary; the middle one, of course, being the true level and the others varying from it, above and below, proportionally to the distance which the upper and lower wires, *A* and *C*, are from the center wire, *B*, of the reticle, and, also, to the distance from the instrument at which the rod is held.

The distance of the outside wires from the center is, within limits, a matter of choice. It should be such as to cover a space of ⅓ foot to 1 foot on the rod held at 100 feet from the instrument.

Before using the instrument on the "line," the leveler should carefully test the variation of the upper and lower lines of sight, *E A* and *E C*, from the center at distances from 100 feet to 1,000 feet from the instrument, and make a table showing the space on the rod which is covered between the center and either outside wire at each 100 feet.

This being done, if the distance at which the rod is held at any time is accurately known, a reading taken with either the upper or lower wire may easily be reduced to the true level reading. Thus, if when the rod is held at 400 feet from the instrument, the space covered between the center and either outside wire being four feet at that distance, as shown by the table, a reading of 10 feet be taken with the lower wire, it is plain that the true reading would be 14 feet; or if a reading of one foot be taken with the upper wire, the true reading will be four feet lower, or three feet below the bottom of the rod. In the latter case the reading should be recorded in the note book as — 3, and must be added to the "height of instrument" to obtain the elevation.



If the distance at which the rod is held is not known with sufficient exactness for the reduction of readings from the outside wires to the center, we may proceed as follows: With the instrument level set the target on the line *E C*, fig. 2.

Then with the leveling screws *turn the telescope down* so that the center line of sight, *E B*, shall take the position *E C*, cutting the center of the target as it was set, and the lower line, *E C*, takes the position *E C'*. Now move the target down until its center falls in the line *E C'*. The difference between the readings *C* and *C'* is the amount which should be added to the reading *C* in order to obtain the true level reading.

The proceeding in case of a high turning point taken with the upper wire would be entirely similar.

There is, of course, a slight error in this operation, but it is so small that in ordinary cases it need not be considered. The error is simply the difference between *twice the tangent* of the angle *B E C* and *the tangent of twice the same angle* multiplied by the distance *E B*.

If *E B* is 600 feet and *B C* 6 feet, then *C C'* is 6 2-1000 feet.

If exact accuracy is required, a list of corrections may be computed and recorded in the table mentioned above, or the distance between the wires of the reticle may be taken less than in the case just mentioned.

If *E B* is 600 feet and *B C* 3 feet, the error will be but half of 1-1000 of a foot.

These extra wires will also be often convenient for making approximate measurement of distances.

The method of doing this will readily suggest itself to any one.

In ordering an instrument from manufacturers these extra wires will usually be put in without extra charge, but in case of an old instrument they may be put in by any one with a little care and patience.

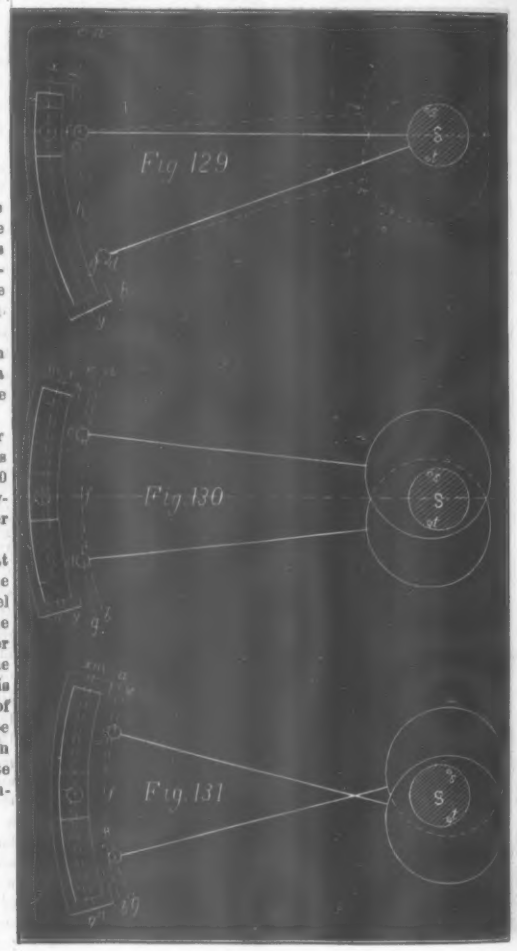
GEO. B. LAKE.

HOWELL, Mich., May 11.

Shimming Tracks in Summer—More Rubble and "Riprap" Wanted.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Much labor and expense may be saved by the use of shims instead of tamping, when doing light surfacing. Roadmasters can do a good thing by giving this matter the attention it deserves. It requires frequent tamping on good ballast to keep the joints up to a good surface, and it is the *frequent tamping* that renders much of this kind of work necessary. It is something like the excessive use of stimulants in the human system. *Much* stimulus creates a demand for *some* more—and the frequent disturbance of the gravel renders a repetition necessary at almost any time. This is what causes it: When a tie has become firmly embedded in gravel a hard crust is formed next the tie from half an inch to an inch in thickness. This crust effectually prevents the tie sinking any further into the ballast, although it is comparatively soft and yielding immediately under the crust. When once this hard surface is broken under the tie, as it will be by tamping, it then lies on a yielding material, notwithstanding it may have been well tamped. And, moreover, if rains occur soon after



tamping they increase the liability of the tie to settle further into the ballast. When a tie has been well tamped and allowed to remain undisturbed long enough for the formation of this crust (which requires but a few days under heavy traffic), wet weather has but little effect on the supporting qualities of the gravel, as the crust is so hard that water will not penetrate it but will pass off in or through the loose gravel between the ties.

Notwithstanding the extreme hardness of this layer next the tie, it yields sufficiently to give the requisite elasticity, and the longer it can consistently remain in that condition, the better. By using shims the joints will keep in good surface for a long time, and two men can surface more track in a given time by shimming than six can by tamping. And I have noticed that ties that have been well shimmed remain sound much longer than those that are not. Decay is hastened by the rail being jammed into the tie, cutting the grain of the wood. Water settles under the rail sufficiently to keep a pulpy mass under the rail, which, by the vibration of the rail under passing trains, is constantly eating into the tie. With a shim of good hard wood, properly fitted, this is prevented. The grain of the shim should be placed at right angles to the rail, and it should be of good width. The shim then receives the action of the rail, and when it has become cut and bruised or decayed it can be replaced with a new one at slight expense. In this way a tie which is expensive will outlast several sets of shims, which cost but a trifle. Ties will last from one to three years longer with shims than without; less labor is required to keep the track up, and the surface of track will be more perfect; then less wear and tear of rolling-stock, etc.,

and those who wish to practice economy to some purpose will do well to attend to this matter at once. Track-men not accustomed to shimming will need some instructions that they may do it properly.

The matter of protection of bridge and trestle foundations is sadly neglected on many roads, and embankments exposed to the action of high water are numerous. It is far cheaper to protect abutments and pile foundations of trestles and heavy embankments with a liberal supply of rubble or rip-rap than it is to wreck a train, to say nothing of the expense of a new bridge and the delays and vexation caused by a smash-up. When the water is low all these things had better be attended to. But don't be deceived by the safe appearance at low water. Put in the rip-rap.

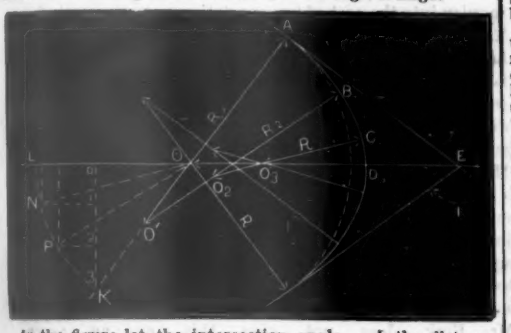
WM. S. HUNTINGTON.

Five-Centered Railroad Curves.

RICHMOND, Va., May 5, 1874.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The following law of five-centered curves renders their use in railroad location simple, and gives a satisfactory method of "easing off" where the central angle is large:



In the figure let the intersection angle $= I$; the distance AE (from *P. C.* or *P. T.* to intersection of tangents) $= T$; radius AO of simple curve $= R$; radius AO of first and last branches of five-centered curve $= R_1$; radius BO_2 of second and fourth branches $= R_2$; radius CO_3 of middle branch $= R_3$; angle $\frac{1}{4}I - AOB = \frac{1}{4}x$; and angle $\frac{1}{4}x - BO_2C = \frac{1}{4}y$; then for all values of I:

If $\sin \frac{1}{4}x = \frac{2}{3} \sin \frac{1}{4}I$ and $\sin \frac{1}{4}y = \frac{1}{3} \sin \frac{1}{4}I$

(when I and T are given)

$R_1 = 3\text{-}2\ T.\ \text{cotang}\ \frac{1}{4}I;\ R_2 = \frac{2}{3} R_1;\ R_3 = \frac{1}{3} R_1$

(when I and R_3 are given)

$R_1 = 8\text{-}3\ R_3;\ R_2 = 5\text{-}3\ R_3;\ T = 16\text{-}9\ R_3 \text{ tang } \frac{1}{4} I.$

Example: Given, $I = 102°$; $T = 1179.8$. Required, angles AOB, BOC and COD, and radii R_1, R_2 and R_3.

$\sin \frac{1}{4}I = 0.777146 = \sin 51° 00';\ 51° 00' - 31° 12' = 19° 48' = AOB_1$

$\frac{2}{3} \sin \frac{1}{4}I = 0.518097 = \sin 31° 12';\ 31° 12' - 15° 01' = 16° 11' = BOC_2$

$\frac{1}{3} \sin \frac{1}{4}I = 0.259049 = \sin 15° 01';\ 15° 01' = COD_3.$

$R_1 = 3\text{-}2 \times 1179.8 \times 0.8098 = 1433.1;\ R_2 = \frac{5}{8} \times 1433.1 = 895.7.$

$R_3 = \frac{1}{3} \times 1433.1 = 537.4.$

Test: $R = T \cot \frac{1}{4}I = 1179.8 \times 0.8098 = \frac{R_1 + R_2 + R_3}{3} = \frac{2866.2}{3} = 955.4.$

The field notes of the five-centered curve are then:

P. C. 4° curve for 19° 48' P.C.C. 6° 24' curve for 16° 11' P.C.C. 10° 41 curve for 30° 02' P.C.C 6° 24' for 16° 11' P.C.C. 4° curve for 19° 48' P.T.

With data $I = 102°$ and $R_3 = 537.4$.

$R_1 = 8\text{-}3 \times 537.4 = 1433.1;\ R_2 = 5\text{-}3 \times 537.4 = 895.7;\ T = 16\text{-}9 \times 537.4 \times 1.2349 = 1179.8$; and angles as before.

Proof by Construction: Draw $AE = T$, and the indefinite line AK perpendicular to AE at A. Measure $AO = R$, and draw EO prolonged to L. Divide the angle $LOK = \frac{1}{4}I$ in the required proportion, as in figure. Measure $AO_1 = R_1$ and draw OB parallel to OP; measure $BO_2 = R_2$ and draw $OC = R_3$ parallel to ON and intersecting OE in O_3, and the distance O_3 will be the radius R_3.

CONWAY R. HOWARD.

Car Grain Trade of New York.

The following paper has been prepared by Mr. H. T. Kneeland, of the firm of Carlos Cobb & Co., New York, for the consideration of a committee of grain receivers and railroad agents:

"Will not New York become the greatest grain mart in the world?" This question is answered affirmatively, we think, in two words—car grain. The enormous increase in this trade the past winter has made it clear to every thinking man that some new plan must be adopted for facilitating deliveries here. Receipts of grain at New York for four years are:

	All sources. Bushels.	Rail receipts. Bushels.
1870	48,637,524	15,100,549
1871	71,125,360	18 955,096
1872	75,198,384	24,697,212
1873	72,714,370	29,583,096

The receipts of grain from January 1 to April 29, 1874, by rail alone were upward of 18,000,000 bushels. This, under the high rates of freight, the hog crop being moved and absorbing a very large portion of the rolling stock of the roads, and terminal facilities that are inadequate to the business of the three great trunk lines, *i. e.*, the New York Central, Erie and Pennsylvania companies, into which the network of railways in the great West pour their through traffic. Western men wonder why large elevators are not constructed, and the business of the port of New York made to conform to an elevator system. Were such elevators built, we doubt if they would meet the requirements of the trade, because by the customs of this port a system of delivery of grain alongside ship has been considered necessary to compete with the canal traffic. So necessary has the system of delivery to ship become that competition has forced the railroad companies to deliver "lighterage free"—not only grain, but cotton, tobacco, flour, provisions, petroleum, &c., when in large quantities. The reasons requiring delivery alongside ship are:

1. It is the mode in which grain has been handled for export, coastwise shipment, local consumption and milling, since the establishment of the grain trade by the Erie Canal.

2. The prejudices of buyers in favor of established customs are difficult to overcome, especially if those customs are warranted by the exigencies of the trade.

3. Steamships and large sailing vessels take mixed cargoes, using grain for ballast and for partial cargo, and depend upon shipments of cotton, provisions and other products of the country to complete the same, as the latter usually pay a better freight.

4. These large craft bring cargoes of general merchandise, requiring dock facilities for unloading, it often being necessary for grain to be unloaded into them for ballast coincident with the unloading of their cargoes.

It is owing to this question of delivery to ship that elevators at the termini of the railroads were not constructed ere this, for it is not to be supposed that the three great trunk lines of railway have failed to build elevators through lack of enterprise or funds. It has been with them purely a question of practicability in view of the customs of our grain trade.

Notwithstanding the immense increase in the car grain trade, New York has been discriminated against by a system requiring shipments of five cars of one kind of grain to insure delivery "lighterage free," less than five cars being subject to lighterage; whereas, to Boston, Philadelphia, and Baltimore single cars are taken at tariff rates, increasing their trade materially by shipments that would naturally come here. Under present methods of railroading a shipment of five cars from any Western point is not likely to arrive here unbroken. Often several days intervene between arrivals of the first and last cars, rendering necessary the holding of the grain either on the track or in boat, awaiting arrival of the balance, or deliveries in small parcels. These delays are very expensive, prevent the unloading of cars promptly on arrival, cause crowds upon the track, increase the number of boats required, and put upon the carrier the cost of delivery in small parcels. Under the present system each shipper's grain must be kept separate.

A plan is now under consideration, by a committee of nine—six of whom are members of the Produce Exchange, and three of whom represent the three trunk lines—to grade the grain upon its arrival and warehouse it temporarily aboard of boats. This plan proposes the establishment of New York grades of inspection for all grain, which would soon become the leading grades of the country, known in all European markets, and to which the trade of the West would naturally conform; grain to be weighed on track scales and loaded into boats irrespectively of ownership, all identity being lost in the grade, but quantity guaranteed, thus permitting consolidation of the receipts on boats ready for immediate delivery, negotiable receipts being issued by the railroad companies, who are permitted to deliver, on orders from owners, any grain of the grade named in such receipts, from any boat they choose, precisely as if the property was in an elevator. The merits of this plan are:

1. It is an immediate relief.

2. Its simplicity; it does not overturn the existing status of our export trade, and vainly endeavor to force it into channels that are unnatural, such as a system of storage elevators involves.

3. It relieves the merchants of a vast amount of labor selling by sample.

4. It enables buyers to get what property they want promptly.

5. It establishes one of the soundest and most perfect systems of warehousing grain that has ever existed. For, if a certain grade of grain is loaded into a boat, that sort must come out! A system of elevators owned by private capitalists interested in having grain go into their warehouses at a low inspection and go out at a high one is thus avoided.

6. The expense of storage on board canal boats (⅛ cent per bushel per day after the first five working days, which are free) is such as to insure prompt delivery from boats, and to prevent unwarrantable speculations in grain.

7. With elevators we could not expect a less rate of storage than two cents a bushel for the first term, and if delivery alongside was then necessary it would involve the cost of lighterage to ship—not less than two cents more, making a discrimination of at least four cents a bushel against rail grain in favor of the canals with which the roads compete. This nominal expense, apparent in every account of sales rendered to Western shippers, would be offset in part by a reduced rate of freight, covering the expense of delivery under the proposed plan, whether appreciated or not.

The plan does not interfere with the building of elevators to any extent, if they are found necessary; for we believe it shadows such an increase in the grain trade of this port as will absorb every facility that can be provided for it.

In conclusion, this plan is simply an adaptation of the grain trade to the necessity of commerce here by a system of small floating warehouses that can be taken to our great ships, whereas at Chicago and Milwaukee the small vessels go to the great warehouses.

H. T. KNEELAND.

BROOKLYN, May 19, 1874.

Transportation in Congress.

In the Senate on the 13th:

Mr. West, of Louisiana, from the Committee on Railroads, reported with amendments, in the nature of a substitute, the Senate bill granting the right of way through the public lands for the construction of a railroad in the States of Alabama and Florida. Placed on the calendar.

The bill proposes to grant to Daniel P. Holland, now proprietor of the Jacksonville, Pensacola & Mobile Railroad, and his associates the right of way through public lands for the construction of a railroad from the present terminus of the Jacksonville, Pensacola & Mobile Railroad, on the Apalachicola River, to the city of Mobile, Ala., with branches to Pensacola and St. Augustine, Fla. The bill reserves to Congress the right to fix the rates of tariff for troops, war materials and United States mails.

Mr. Windom, of Minnesota, submitted the following preamble and resolution, which he gave notice he would ask the Senate to consider after the Finance and Civil Rights bill shall have been disposed of:

Whereas, Cheap and ample means for the interchange of commodities between the different sections of our country constitute essential conditions of national advancement and prosperity; and,

Whereas, The Committee on Transportation, after a full investigation of the subject, report that in their judgment cheap transportation can be obtained only through competition under Governmental control, and operating through cheaper means of transportation than are now provided; that such cheaper means of transport can be provided only by the construction of double-track freight railways, or by the improvement and creation of water routes; and that, after a most careful consideration of the merits of the various proposed improvements, taking into account the cost, practicability and probable advantages of each, they have come to the unanimous conclusion that the following are the most feasible and advantageous channels of commerce to be created or improved by the National Government in case Congress shall act upon the subject, namely: *First:* The Mississippi River; *Second:* A continuous water line of adequate capacity from the Mississippi River to the city of New York via the Northern lakes; *Third:* A route adequate to the wants of commerce through the central tier of States from the Mississippi River via the Ohio and Kanawha Rivers to a point in West Virginia, and thence by canal and slack water, or by a freight railway, to tide water; *Fourth:* A route from the Mississippi River via the Ohio and Tennessee Rivers to a point in Alabama or Tennessee, and thence by canal and slack water, or by a freight railway, to the ocean: and

Whereas, The said Committee express the opinion that among other benefits and advantages the completion of the system of improvements suggested by them will effect a permanent reduction of 50 per cent. in the cost of transporting fourth-class freight from the valley of the Mississippi River to the seaboard, and a similar reduction in return freight, thereby insuring remunerative prices to the farmers of the West, cheaper food to the manufacturer and laborer of the East and the cotton-planter of the South, the advancement by many hundreds of millions in the value of Western and Southern lands, and a very large increase in the exportations of cotton and cereal products; and

Whereas, The report of the Select Committee recommends that careful surveys and estimates be made upon such portions of said routes as may be necessary to determine accurately the cost of each, and to enable Congress at its next session to enter upon the said system of improvements, if upon the completion of such surveys and estimates the same shall be deemed practicable and expedient; therefore,

Resolved, That the Committee on Appropriations be and hereby are instructed to report amendments to the River and Harbor bill, making appropriations for completing the surveys and estimates for each of the improvements recommended by said Select Committee on the four routes indicated in said report.

The preamble and resolution were, on Mr. Windom's motion, ordered to lie on the table and be printed.

Mr. Sherman, of Ohio, introduced a bill to regulate commerce among the several States and with foreign nations. Referred to the Committee on Transportation.

Mr. Sherman's bill to regulate commerce among the several States and with foreign nations is a copy of the bill introduced by Mr. John Q. Smith, of Ohio, in the House of Representatives, March 16, forbidding discriminations in railroad charges and compelling railroad companies to post conspicuously full schedules of their respective tariffs, &c.

In the Senate on the 15th:

Mr. Windom, of Minnesota, introduced a bill to establish a Bureau of Internal Commerce, to be attached to the Treasury Department and be under the direction of a Commissioner of Internal Commerce, who shall be appointed by the President and confirmed by the Senate. The duties of the bureau shall be to gather, collate and annually report to Congress statistics and facts relating to commerce among the States, and especially to railroads and their charges, management, &c. The bill provides that it shall be obligatory on all corporations to make annual reports to said bureau, giving information in detail on these and cognate subjects.

In the Senate on the 25th:

Mr. Scott, of Pennsylvania, called up the Senate bill supplementary to the act to incorporate the Texas Pacific Railroad Company, and to aid in the construction of the road. He explained that the bill was for the purpose of enabling the Company to execute a mortgage upon the portion of its road completed.

Mr. Edmunds, of Vermont, submitted an amendment, as follows: "That nothing in this act shall be construed to have the effect to entitle said corporation to any other or further rights to public lands, or in any other respect as against the United States, than such as by law it is now entitled to." Agreed to, and the bill was passed as amended.

In the House on the 25th:

Mr. Dunnell, of Minnesota, moved to suspend the rules and pass a bill extending till March 3, 1876, the time for completing the St. Paul & Pacific Railroad. Lost, 114 to 98—not two-thirds in the affirmative.

Committees Appointed by the Master Mechanics' Association.

The committees appointed at the late meeting to report on the subjects for next year are as follows:

1. The best material, construction, operation and management of locomotive boilers. J. M. Boon, Pittsburgh, Fort Wayne & Chicago; John A. Jackman, Chicago & Alton; George W. Cushing, Toledo, Wabash & Western.

2. Purification of feed water—what methods up to this time have been most approved for the improvement of feed water by chemical and mechanical means, and for the prevention of incrustation. Horace A. Towne, Northern Pacific; Coleman Sellers, Wm. Sellers & Co., Philadelphia; H. Elliot, Ohio & Mississippi.

3. Locomotive tests. This committee to request members to make experimental tests to show the performance of locomotives, and to report the results to this Association. M. N. Forney, RAILROAD GAZETTE; Prof. R. H. Thurston, Steven's Institute of Technology; F. W. Peckham, Central Railroad of New Jersey.

4. Locomotive construction. This committee to report as far as possible all new methods of construction which have been adopted by members during the past and ensuing year. James Sedgley, Lake Shore & Michigan Southern; L. S. Young, Cleveland, Columbus, Cincinnati and Indianapolis; Howard Fry, Erie Railway.

5. The best system of signals for operating railroad trains, to include train head signals, train tail and side signals, road or station switch signals, and appliances for indicating the speed of trains. John Thompson, Eastern; A. B. Underhill, Boston & Albany; J. Ortton, Great Western of Canada.

6. Locomotive and tender wheels. This committee to report breakages of wheels and tires, removals of tires, and causes of breakage or removal, and to report upon the different methods of construction and manufacturing of various kinds of engine and tender wheels. James W. Lauder, Northern of New Hampshire: G. W. Strattan, Pennsylvania; S. A. Hodgman, Philadelphia, Wilmington & Baltimore.

7. Construction and improvement of continuous train brakes during the ensuing year, and their application to cars and locomotives. J. R. Peddle, St. Louis, Vandalia & Terre Haute; A. Gould, New York Central; G. B. Richards, Boston & Providence.

8. Lubricants for locomotives. F. B. Miles, Ferris & Miles, Philadelphia; H. D. Garrett, Pennsylvania; E. Garfield, Hartford, Providence & Fishkill.

9. Mechanical laboratory. Wm. A. Robinson, Great Western of Canada; Reuben Wells, Jeffersonville, Madison & Indianapolis; J. M. Boon, Pittsburgh, Fort Wayne & Chicago; N. E. Chapman, Cleveland & Pittsburgh; H. M. Britton, Whitewater Valley.

10. Narrow and broad-gauge rolling stock. W. S. Hudson, Rogers' Locomotive Works; H. N. Sprague, Porter Bell & Co.

11. Standard axles. M. N. Forney, RAILROAD GAZETTE; Coleman Sellers, Wm. Sellers & Co., Philadelphia; Gordon H. Nott, Boston.

RAILROAD GAZETTE

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CONDUCTED BY

S. WRIGHT DUNNING AND M. N. FORNEY.

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Editorial Announcements.

Addresses.—*Business letters should be addressed and drafts made payable to* THE RAILROAD GAZETTE. *Communications for the attention of the Editors should be addressed* EDITOR RAILROAD GAZETTE.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

THE COST OF RAILROAD TRANSPORTATION.*

One of the good effects of the charges of extortion so freely made in these days against railroad companies, and of the many attempts by means of legislation to reduce materially the charges for transportation, is the recognition by railroad managers of the advisibility or even necessity of an exposition of elements of the cost of transportation in terms as clear and well suited for popular apprehension as the complicated nature of the subject and its unfamiliarity to the public will admit. Indeed, in some States it is just as necessary to do this as to care for the road-bed, in order to preserve the railroad property to its proprietors. We see, therefore, that several eminent railroad men have almost simultaneously published investigations, more or less searching into this subject, such, for example, as the able paper by Mr. Chanute, of the Erie, read before the American Society of Civil Engineers, the extremely interesting paper by Mr. Morehouse, of the Illinois Central, read before the Civil Engineers' Club of the Northwest and published in these columns this week, and the work by Mr. Albert Fink, Vice-President and General Superintendent of the Louisville & Nashville & Great Southern, which forms the text of this article which, we warn the reader, will be descriptive rather than critical.

Mr. Fink's treatise, only a portion of which is yet in print—that relating to transportation by passenger trains—is in the nature of an investigation of a series of special cases which together demonstrate certain general principles. It is based chiefly on the returns for a series of years of the Louisville & Nashville & Great Southern Railroad, which are admirably suited for this purpose from the variety of the property, which consists now of seven different lines under quite various circumstances as regards the characteristics of road and the nature and bulk of their traffic, and the fact that the accounts for each line have been kept separately and quite minutely. In this respect this company's published reports stand almost or quite alone. These materials are given with the work in the form of eight large tables. These tables give figures for seven years under ninety heads for passenger and freight trains on the Main Stem (Louisville to Nashville) and the Knoxville Branch and for five years on the Memphis Branch; for mixed trains on the Richmond Branch for five years under sixty-nine heads, and for seven years on the Bardstown Branch, and for passenger and freight trains under ninety heads for two years on the Memphis Line and for one year on the Nashville & Decatur Division. Table VII. gives the cost per train-mile of fifty-nine items of expense for the Main Stem, the Knoxville Branch and the Memphis Line, for one year, thirty-three of them for both passenger and freight trains. The last table gives the weight, seating capacity, length and number of wheels in trucks of all passenger-train cars on the road, the size of mail-rooms and express rooms of baggage and postal cars, the number and weight of freight cars, the average weight of each class of cars for seven successive years, and of the different classes of locomotives for the same years.

Thus the material is exceptionally full and minute, and relates to several different kinds of roads, some with a large, some with a small and some with no through traffic, while some are cheap and easily worked, while others are costly and, owing to the heavy grades and sharp curves, are costly to work.

The causes of the differences of cost of railroad transportation Mr. Fink divides under these five different heads: I. The character of the road; II. Cost of labor and material; III. The speed of trains; IV. The amount and nature of the business of the road; V. The cost of the road and equipment. Under these heads he proceeds to consider the cost per train-mile. We copy that under the fourth head (page 9):

"*The Amount and the Nature of the Business Transacted, and their Influence upon the Cost of Transportation.*

"The operating expenses may be divided into three classes: First, certain expenses must be incurred, whether one or one hundred trains pass over a road; the road-bed must be kept in order, bridges in repair, ditches clear, cross-ties and other woodwork replaced when decayed, etc. This class of expenditures, entirely independent of the number of trains passed over a road, I will hereafter term 'constant expenditures.' When distributed over a larger number of train-miles, the average cost per train-mile, and consequently the average cost of transporting one ton or one passenger per mile, is thereby reduced.

"Under a second class of expenditures may be comprised all that are in some measure reduced with the increase of the number of train-miles, but not in the same proportion. To this class belong the general expenses, superintendence, the cost of adjustment of track, the cost of agencies, etc.

"The third class of expenditures increases in direct proportion as the number of trains over a road is increased. To this class belong engineers' wages, engine repairs, fuel, etc. In considering the items of cost which make up the cost per train-mile this subject will be more particularly referred to. For the present it suffices to refer merely to the general principles governing the difference in the cost of transportation on roads on which the amount of business differs.

"As an illustration of the effect of increased business on the reduction of the cost of transportation we will refer to Table I. On the 10th line of this table it will be seen that in 1867 8.55 trains were daily run over the Main Stem of the Louisville & Nashville Railroad. From that time on there has been a gradual increase in the number of trains, and in 1873 17.49 were run daily over the road. During the same period the expenditures per freight-train mile were reduced (see line 53) from $1.97 in 1867 to $1.59 in 1873, and the cost of carrying one ton of freight one mile (see line 89) from 2.19 cents in 1867 to 1.44 cents in 1873. There were other causes, which will be referred to hereafter, that aided in the reduction of expenditures per ton per mile; but the chief cause was the increase of business.

"But not only the amount, but also the nature of the business, influences greatly the cost of transportation on different roads.

"On some roads a large proportion of the freight is carried in one direction and only a small proportion in the other; on other roads the amount of traffic may be more evenly balanced in opposite directions. Suppose a road on which the freight traffic is all in one direction, and another on which it is the same both ways; the average load of a train would be twice as much on the latter road as it is on the former, and under the supposition that the cost per train-mile was the same, the cost per ton would be only one-half.

"On a road which does only a local business, the average load carried in trains will be less than on a road where there is a large amount of business carried over the whole length of the road in both directions, and the cost of transportation of local freight will be so much greater. Thus, referring to Table II, line 77, it will be seen that the average number of tons carried in one train on the Knoxville Branch, a mere local road, averages from 52.55 to 66.66 net tons per train during seven years; while on the main stem, over which a large amount of through business is transacted, it varies during the same period of time (see Table I, line 76) from 89.85 to 110.75 tons per train. No greater number of trains is run on the Knoxville Branch than is absolutely necessary to transact the business, and it is on account of the peculiar nature of the business that makes it impossible to carry the same net load on each train as is carried on the main stem."

The effect of cost of road and equipment is investigated similarly and shown to vary (counting interest at 7 per cent.) from 50.05 per cent. of the working expenses on the Main Stem of the road under consideration in 1867 to 37.87 per cent. in 1873, and from 1.14 cents per ton per mile the first year to 0.55 cent the last; while on the Knoxville Branch it varied in that period from 99.44 to 192.43 per cent. of the working expenses, and from 2.38 to 5 cents per ton per mile, and on the Richmond Branch reached at one time 243.12 per cent. of the working expenses and 11.56 cents per ton per mile. Under this head is given a table showing for the Pennsylvania, the Erie, the New York Central, the Lake Shore & Michigan Southern and three lines of the Louisville & Nashville, 1, the number of trains daily; 2, cost per passenger train per mile; 3, cost per freight train per mile; 4, average cost per train mile; 5, average number of net tons carried on each train; 6, cost per ton per mile; 7, percentage of interest to operating expenses; 8, total cost per ton per mile, including interest. This table shows that while the Pennsylvania and New York Central must add but little more than one-quarter to the working expenses in order to make an income of 7 per cent. on their capital; the Erie and Lake Shore must add more than 50 per cent., and the Louisville & Nashville 41 per cent. on its Main Stem, 132 per cent. on the Knoxville Branch, and 177 per cent. on the Richmond Branch; while the average rate on the Pennsylvania, in order to make this income, is but 1.05 cents per ton per mile, on the Richmond Branch it is as much as 10.55 cents. These illustrations should be applied to one of the Illinois roads with numerous branches, such as the Chicago & Northwestern, the Chicago, Burlington & Quincy, or the Chicago & Alton, which probably would show differences as great as the different lines of the Louisville & Nashville, but by the present law are directed to charge equal rates for equal distances everywhere on their lines, the Legislature having ignored the conclusion to which Mr. Fink arrives, "that it is impossible to secure uniformity in rates for railway transportation with due regard to the rights of the parties performing the service."

So far (to page 13) the investigation is general; the remainder of the sheets now printed are occupied with an inquiry into the cost of transportation on passenger trains. The first matter here considered is one much mooted and here as elsewhere decided arbitrarily without the basis of facts (which must somewhere have been collected, it would seem) which alone can be decisive. This is the division of the cost of maintenance of road and structures and general expenses between passenger and freight trains. Mr. Fink adopts, for the wear of rails, for different trains, a division of expenses in proportion to their gross weight multiplied by their average speed; so that a train weighing 100 tons running 30 miles an hour is estimated to damage the track to the same extent as a train weighing 300 tons at 10 miles an hour. This probably would depend to some extent on the condition of the track; Mr. Fink does not give this as an ascertained principle, however, but as a basis for estimates which takes both speed and weight into consideration and is probably not far from wrong. It has the advantage of convenience at least, as, on the Louisville & Nashville and many other roads, it makes the cost *per train* the same for both passenger and freight trains, the superior speed of the former.

The inquiries then are as to the cost per mile per passenger train and the cost per mile of passenger car; the latter is seen to vary during a term of seven years on five lines of the Louisville & Nashville from 26.28 to 40.88 cents, and with the proper proportion for interest on investment added, from 37.17 to 102.73 cents. Here we have a company which must charge 175 per cent. more per passenger per mile on one of its lines than on another, or else discriminate between them. If a rate of three cents per mile was proper on the Main Stem in 1872, 8¼ cents would have been only fair on the Knoxville Branch in 1868.

There follows an investigation into the various paying loads of passenger-train cars, which consist of passengers carried in three ways (in regular passenger cars, sleeping cars and parlor cars); of baggage; express matter carried in two ways (in baggage cars and in special cars), and of mails carried in three ways (in postal cars, in special apartments of baggage cars, and like ordinary baggage in baggage cars). In this connection is given the average cost, with and without interest on the investment, of a gross ton of passenger train per mile for a series of years on different lines of the Louisville & Nashville (varying from 1.23 to 2.14 cents without interest, and from 1.74 to 5.88 cents with); and of a net ton of passenger-train load per mile (varying from 14.85 to 25.53 cents without interest and from 24.30 to 66.46 cents with), the general average without interest having been about 20 cents per ton per mile. This examination of the cost of the different kinds of transportation by passenger trains is, so far as we know, unique, and certainly leads to very important results. For instance, while the working expenses per passenger per mile, without baggage, over the Louisville & Nashville Main Stem, is shown to have been 1.51 cents in regular passenger cars, it was 4.32 cents in sleeping cars; and while it cost the company 33.4 per ton per mile to carry mail in postal cars, to carry it in baggage cars cost but 11.1 cents. Express matter was carried at a cost to the railroad company of 14.17 cents per ton per mile, and passengers' baggage at 10.48 cents. The average cost of carrying passengers' baggage per mile traveled by passengers was the quite appreciable sum of 0.27 cents, being an addition of 18 per cent. to the cost of carrying a passenger in the regular passenger cars. These calculations are made also for the passenger trains on the Knoxville Branch, which, however, have less variety in their traffic.

Resulting from this is consideration of sleeping-car traffic, which was introduced on the assumption that a sleeping car would take the place of an ordinary car, and, costing no more to haul, would carry the same number of passengers. It turns out, however, that in the first place the sleeping car is made nearly twice as heavy as the ordinary coach, and, in the second place, that it carries only about half as many passengers, so that to carry the same number of passengers in sleepers the railroad company

* An Investigation into the Cost of Transportation on American Railroads, with Deductions for its Cheapening. By Albert Fink, C. E., Vice-President and General Superintendent of the Louisville & Nashville & Great Southern Railroad. Louisville: Printed by John P. Morton & Co., 1874.

must haul about four times as much weight. Mr. Fink, apparently frightened by this bad showing for the sleeping cars, makes another calculation to show how much is added to the cost per train mile by the addition of a sleeper, in cases where the locomotive power is sufficient to admit of such addition. This makes a favorable showing. But no claim is made that the cost of sleeping-car service should be estimated on this basis, and the calculation is followed by another showing the cost of the service when the condition of a sleeping car would make the train too heavy, and when, therefore, it results in the addition of another train to the service. Here the distinction, usually not sufficiently considered, is well developed between the *average* cost of any special service and the *addition* to the total cost occasioned by such service. The former must form the basis for the *average* charges of the road; the latter is the limit at which any single service can be performed without decreasing the net profits.

The concluding investigation, that concerning the cost of carrying mails in different ways, which is pursued in the same way and is very complete and convincing, we published last week.

The work, though still incomplete, is the fullest investigation into the cost of railroad transportation ever published in our country or language, we believe, and is in many respects an admirable piece of work. Not the least of its merits is its logical order and clearness. Doubtless a more minute account and division of expenses would be necessary for perfect accuracy, but the figures given are unusually full, and they cover lines of different kinds for considerable periods. Accepting the figures given, there is usually no escape from the conclusions arrived at. They follow from the premises and have something of the conclusiveness of a geometrical demonstration. And they will be the more useful because, wherever the accounts are kept fully enough, they can be followed for any railroad. A simple transposition of figures will enable any manager to read the results for his own road, and what is more, demonstrate their truthfulness to its patrons.

merican Investments in Holland.

A banking house in Amsterdam has compiled a statement of American railroad loans taken in Holland, mostly within the past five years, with a mark distinguishing those which were in default on the 1st of January last. This statement, which is published in the New York *Daily Bulletin*, gives a list of sixty-five different securities, the whole amount of which is $287,776,000, and $125,675,000 was taken in Holland. Of these twenty-seven different securities, $54,150,000 of which was subscribed in Holland, were in default on the 1st of January, more than 43 per cent. of the whole. In the list are subscriptions to the amount of $19,700,000 which have made default since, while none of the others have resumed, so we find that $73,850,000 of the Dutch subscriptions, or nearly 59 per cent. of them, are at present in default. Few Americans are aware how largely we have depended upon the Dutch for capital. This list shows that the largest part of the Chicago & Northwestern, about one-third of the Central Pacific, two-thirds each of the California & Oregon and San Joaquin Valley, nearly all of the St. Paul & Pacific issues, most of the Marietta & Pittsburgh, the Denver Pacific, the Atlantic, Mississippi & Ohio consolidated, the Missouri, Kansas & Texas, the Port Huron & Chicago, the Cleveland, Mount Vernon & Delaware, all of the Denver & Rio Grande and Denver & Boulder Valley, most of the West Wisconsin, of the Chicago & Southwestern and the Paducah & Memphis, all the Cairo & St. Louis, most of the Elizabethtown & Paducah, all of the Missouri & Kansas Bridge, most of the Maxwell Estate, all of the Costella Estate and half of the Florida State railroad bonds were taken in Holland. It is impossible, of course, to say what proportion of them is still held there, but until recently Holland was more likely to be a buyer than a seller of most of these securities, and the holdings there must now be enormous. The effect of the failure to pay interest on nearly three-fifths of these bonds may be imagined. American credit, heretofore so good in that small but wealthy country, must have received an almost fatal blow. Especially is this the case with new railroad projects. Of the whole amount in default at least $53,000,000, or nearly three-fourths of the whole, consists of the bonds of new roads—roads which either were not in operation or were but partly operated when these issues of bonds were sold.

It does not follow, however, that we shall get no more Dutch or other European capital, nor even that such capital will no longer be invested in new American railroads. It indicates rather that such new railroads, to attract foreign capital, will probably have to be undertaken or guaranteed by companies with roads in successful operation and of unquestionable soundness. Such companies within the past few years have in many cases involved themselves greatly by such undertakings, but in no case, we believe, have they failed to protect the bonds of the new lines. They are likely hereafter to exercise greater caution in the schemes which they undertake or support, but when they do undertake them the clear record which they have made through this time of trial will be likely to stand them in good stead, and make it reasonably easy to obtain whatever capital they may need.

Boston Grain Shipments.

Boston is much excited by the threatened withdrawal of the Cunard steamers, which would have a deplorable effect on its import and export trade. As the withdrawal is based on the lack of cargoes outward, the remedy evidently is the provision of more abundant exports. To aid in this committees of the Board of Trade and Commercial Exchange of that city have united in a series of resolutions which request the Boston & Albany Railroad Company to make the freight rates such that they will be as low to Boston as to New York from all interior points, and also to reduce its elevator charges. The Boston & Albany railroad Company, of course, is not interested in cultivating any Boston traffic which will not, directly or indirectly, increase its profits. At present the rate on fourth-class freight, grain, etc., is five cents higher from Chicago to Boston than to New York; the distance by the shortest routes (which make the rates) being about 10 per cent. greater to the former place. Nearly all the Boston freight which passes over the Boston & Albany comes to it from the New York Central & Hudson River. Now the latter cannot with very good grace be asked to make any sacrifice for the purpose of diverting freight from New York to Boston, as on New York freight it gets a haul one-half longer than on Boston freight. If the Boston & Albany must make the whole amount of the reduction to equal New York rates, then it must accept for the 200 miles of hill and mountain road between Albany and Boston a rate as low as that allowed for the 144 miles of level road from Albany to New York, where, probably, the same engine can haul twice as many cars as on the Boston & Albany. Probably it *costs* about twice as much to haul to Boston from Albany as to New York, but the better terminal facilities at Boston may partly counterbalance the advantage in distance and grades. Dividing on the basis of distance, the Boston & Albany should receive one-fifth of the rate from Chicago to Boston, or ten cents per hundred at the current rates for grain. Should it assume the cost of a reduction to New York rates it would get but five cents, or just ¼ cent per ton per mile, which is something less than one-third of its average receipt from *through* freight for the last year reported, and less by at least one-third than the lowest reported *cost* per ton per mile of carrying freight on any American railroad. By no possibility can freight be got to Boston from points west of Albany at a cost so low as to New York. The distance by the shortest route is greater and the route very much more difficult. If the rates to the two ports are made the same, then there will be a discrimination against New York. If the total bulk of traffic were increased by such a discrimination, provided it should not make the Boston rate less than cost, it would be entirely justifiable and might be advisable; but every bushel of grain taken to Boston for export is diverted from New York or some other port, and does not increase but decreases the traffic and earnings of the road connecting with the Boston & Albany. It is not easy to see how this disadvantage of position for grain exports can be overcome *west of Boston*. If Boston is further from Chicago than New York, however, it is nearer to Liverpool; and it may legitimately make all it can out of that advantage. It probably does not prevent the rates to Liverpool being the same from the two cities; but certainly no artificial means cause that. If the day shall come when the way will be clear from the upper lakes to the St. Lawrence, Boston will be quite as near to the current of grain traffic as New York is; but then neither New York nor Chicago will be likely to have much to do with grain exports.

The Farmers' Movement as a Question of Social Science.

"The Farmers' Movement" is the title of a paper prepared by Willard C. Flagg, of Moro, Ill., for the session of the American Social Science Association, held in New York last week. Mr. Flagg has been so prominent a leader in the agitation in the West concerning regulating railroad charges by law that a formulation by him of the principles on which he would base legislative action, or a definite statement of the reasons which call for such regulation, would be read with interest. But the paper gives nothing of the kind. It is simply a general charge that the farmers are abused and cheated by the rest of the community and that the movement is an effort to adopt radical measures for a remedy. Nearly the whole portion of the statement of grievances is contained in the following paragraph:

"In all the past ages the agricultural class, like the other industrial classes, has by force, fraud or cunning been prevented from gaining more than a subsistence by its labors. The robber baron, the mediæval merchant, the royal taxgatherer, and the railway monopoly have thriven; but the men who, in rain and sun, toiled early and late, painfully and penuriously, have seldom, if at all, received a due reward for their labor. Agriculture has been a system of spoliation. The landlord, the transporter, and the middleman rob the farmer. The farmer robs the land, and worn out lands remain to tell the story of bad husbandry and worse political economy."

If this means anything, it means communism; and that, we imagine, will make very little progress during this generation in America, and least of all in a farming community where nearly every voter has or expects to have property of his own, and, more than that, landed property, the one form of property whose value is enhanced without effort or expenditure by the owner, and to which railroad companies have contributed a value many times greater than that of their own properties.

This general assertion of grievances unsupported by facts was met in the discussion by the following statement by Mr. S. B. Ruggles:

"S. B. Ruggles said that the people of ten States lying north of the Ohio River owned, in 1850, farm property valued at $914,000,000. The population of these States had doubled in the past ten years. In 1870, the value of this farm property was $5,132,000,000. The value of the farm products was not given in 1850 and 1860, but in 1870 is was shown in these States to be $978,000,000. The farmer was not a serf. He had no tyrannical landlord to oppress him. It was shown that 975 out of every 1,000 farmers in this section owned their farms. In 20 years they had accumulated $5,000,000,000 worth of property. The census of 1870 showed that there were 2,000,000 farmers. This would give an average amount of $2,400 to each. It is shown that they had paid their help less than 10 per cent. of their income. They had paid $91,000,000 for help. It was shown that each and all of these poverty-stricken farmers, above the age of 10 years, were in the receipt of an income of $460."

It would not be difficult to show, of course, that the land owners, however small or unsatisfactory their incomes may be, have had their property increased in value by the investments of other people in railroads to an extent immeasurably greater than the total profits of the railroad builders and the railroad owners; and that in numerous cases millions of dollars invested in a railroad have increased the value of real property owned along the line by one-half or more, while the railroad proprietors have made no income at all. This is no reason why the railroad owners should have a bounty secured by law from the land owners, but it is a very good reason why the railroad owners should be permitted to make an income by their railroad business, and not be compelled to pay a bounty to the landowners, as they virtually would do, if forced by law to carry for rates less than those necessary to earn a reasonable interest on their investment.

Lake Vessels on the Atlantic.

Low lake rates prevail this spring, being about equal to the midsummer rates of a season when vessels are plenty. These rates, it must be remembered, are coincident with an unusually heavy grain traffic, though it is possible that there is not now any extraordinary amount of grain to go forward, for the reason that the rail grain shipments last winter were of unexampled extent, and have left for the vessels less than could have been expected last fall according to all previous experience. The lake marine probably has increased very little in tonnage since last year, as rates were not profitable then, but it had been stimulated by the high and profitable rates of 1872, which not infrequently, it is said, enabled vessels to earn not their own value in the single season. The tonnage was then already in excess of the demand, probably, while this year, owing to the depression in the iron interests, more than half of the great fleet engaged last year in carrying Lake Superior ore to Lake Erie ports is released and compelled to resort chiefly to grain-carrying for occupation. The lumber trade, too, is in a depressed condition, and the prospect for vessel owners is decidedly discouraging. There is talk of beginning direct shipments from Chicago through to Liverpool on a large scale, to find employment for some of this superfluous tonnage; for ocean rates are not low, but high. About 22 cents per bushel is paid from New York to Liverpool, while from Chicago to Buffalo, one-third of that distance, four cents is accepted. There is no difficulty in the way of making such shipments, except the prime difficulty of making them profitable. Almost every year one or more lake vessels have made the voyage from Chicago to Liverpool, but it is noticeable that they rarely make it a second time, which, we may assume, they would do if money was to be made by it. Those who have investigated the matter say that as a general thing through shipments cannot be made economically; that is, that the costlier equipment and larger crew needed on the ocean would add to the expense on the lakes more than the cost of transferring from the lake to the ocean vessel on the St. Lawrence, which, indeed, need be very slight. But it may be true enough that such lake vessels as are fitted for ocean voyages or can easily be so fitted will, under the present circumstances, find it greatly to their interest to exchange fresh for salt water; which leads to the inquiry whether, when the Canadian canals are sufficiently enlarged to pass most or all lake vessels, the latter may not find an available field for their activity on the high seas, not only in times of depression of traffic on the lakes, like the present, but also every winter during the five months when navigation is closed. There is an immense tonnage on the lakes, and half of it added to the Atlantic fleet would doubtless be able to carry all the grain exports of the country within five months.

Record of New Railroad Construction.

This number of the RAILROAD GAZETTE has information of the laying of track on new railroads as follows:

Rhinebeck & Connecticut.—Extended from Mount Ross northeastward 4 miles to Gallatinville, N. Y.

This makes 427 miles completed in the United States in 1874.

THE FREIGHT MOVEMENT ON THE PENNSYLVANIA RAILROAD seems to have the same overwhelming excess eastward as is noticeable on most other north and south roads, in spite of its varied mineral traffic. The tonnage mileage of through freight eastward in 1873 was 73 per cent. of the total through tonnage mileage; and in local freight the tonnage mileage eastward was no less than 86 per cent. Of the whole movement, in both directions, 76.3 was eastward, so that more than two-thirds of the cars must have been hauled west empty.

The inequality in the movement increases, as might naturally be expected; for the West increases constantly its heavy exports and *decreases* (proportionally) its heavy imports, manufacturing more and more every year the coarser and heavier articles which but lately it imported almost entirely. The desirability of cultivating any kind of *new* westward traffic which will pay even a part of the expense of moving the trains in that direction is evident. As it is, the train-load eastward has to pay besides the expense of its own running two-thirds of the cost of hauling the train back again. It is in view of this fact that we have intimated that such an improvement of the Lake and St. Lawrence or Lake and Canal route as should make the

water rates very much lower and entirely deprive the railroads of the traffic in grain carried for export might be really a benefit to the latter. Any great cheapening of grain transportation to Europe would give an immense impulse to Western production, and, of course, to the growth of the West in population, wealth and consumption; so that the place of the grain might be more than made up by the more valuable products which will take the railroad at rates higher than grain now pays, and especially so that the westward movement would become more nearly equal to the eastward, and something like charges on two train-loads might be collected from a round trip, instead of on a train-load and a third, as now.

THE PENNSYLVANIA RAILROAD'S GUARANTEES are tabulated in the full annual report. There are twenty-five companies, besides the New Jersey lines, whose bonds have been guaranteed by the Pennsylvania Railroad Company, sometimes in connection with leases to other companies, all being railroad companies except one coal, one canal and one steamship company. Four of these pay their own interest and, not being leased, return no surplus to the guarantor. Eight return a surplus, the total of which is $1,822,441.39, while eleven leave deficits amounting in all to $3,144,467.47, leaving a total deficit of $1,322,026.08. The lines are divided into two groups, those east and those west of Pittsburgh. Only one of the former, the Western Pennsylvania, returns a surplus ($240,969). The deficits are as follows:

Philadelphia & Erie	$509,594 96
Williamsport & Elmira (leased to Northern Central	108,068 65
Baltimore & Potomac	207,000 00
Pittsburgh, Virginia & Charleston	53,940 00
Danville, Hazleton & Wilkesbarre	105,186 26
American Steamship Co.	90,000 00
	$1,163,749 87
Add to this the loss on the New Jersey lease	685,689 70
	$1,849,439 57

The thirteen roads west of Pittsburgh are all worked by the Pennsylvania Company. Seven of these show a surplus and six a deficit. The Pittsburgh, Fort Wayne & Chicago with the two short branches which are leased to it bring in a surplus of $957,192.44, the Erie & Pittsburgh $103,772.74, the Cleveland & Pittsburgh $459,659.59. The Little Miami road is charged with $548,752.17 of the loss, and the Columbus, Chicago & Indiana Central with $1,110,159.33. The total loss on guarantees, including the New Jersey lease, is $2,007,715.78.

Of the companies which cause a deficit, the Baltimore & Potomac and the Pittsburgh, Virginia & Charleston, are reported as having expended their net earnings for new construction, and both, with the American Steamship Company, are too young to be expected to support themselves quite yet.

THE MEXICAN RAILROAD concession, according to information contained in private letters received by the last mail, met its death under the following circumstances: The "Fourteen," to whom the contract had been granted, addressed a proposition to Congress for the modification of their contract, in which they alleged that after diligent efforts they had been unable to borrow a dollar in Europe, and had been almost equally unsuccessful at home. In view of these circumstances they proposed that the work for the present be limited to the construction of a line from Mexico to Queretaro (130 miles), the cost of which was estimated at $4,000,000. The capital they proposed to have provided as follows: The Government to supply $2,000,000 and the company secure subscriptions of $1,000,000 in the first instance, which having been expended in the work it was believed that $1,000,000 could be raised by a mortgage on the property. While this proposition was pending, the Minister of Public Works announced, in reply to an interpellation by a member, that the administration had declared the concession forfeited, the compensators not having deposited the bond required by the terms of the concession. It is also reported that subsequently a meeting of the "Fourteen" was held at which the association was formally dissolved.

THE AVERAGE FREIGHT LOCOMOTIVE PERFORMANCE on the Pennsylvania Railroad in 1873, according to Mr. Cassatt's (the General Manager's) report, was the hauling of 110 tons of freight per mile run. As about three-fourths of the whole freight was east-bound, of the 220 tons hauled in running one mile east and one west, 165 would be east-bound, so that the average freight-train load in that direction on the Pennsylvania Railroad may be counted as 16½ fully loaded cars, and the average west-bound train as 5¼ loaded and 11 empty cars.

THE RAILWAY ASSOCIATION OF AMERICA, we learn, was so slimly attended at the half-yearly meeting in Indianapolis last week that an adjournment was had without attempting to do any business.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

—Mr. W. M. Riter has been appointed Superintendent of the Summit County Railroad, with office at Coalville, Utah, in place of Bishop W. W. Cluff, who has resigned.

—Mr. G. W. Norris, General Superintendent of the Springfield & Illinois Southeastern Railway, having resigned, the duties of that position will be performed by C. A. Beecher, the General Manager. Mr. J. M. Longstreet is appointed Train Master, with office at Pana, Ill., in place of S. P. Peabody, who has resigned.

—The directors of the New Haven & Derby Railroad Company have elected officers as follows: President, Morris Tyler; Vice-President, Henry S. Dawson; Treasurer, Charles Atwater; Secretary, F. E. Harrison; Superintendent, E. S. Quintard.

—Mr. E. Murdock, Jr., has been re-elected President of the Cheshire Railroad Company and J. H. Elliott Clerk.

—The receivers of the Cairo & Vincennes Railroad have made the following appointments: General Freight and Ticket Agent, W. B. Goodrich; Auditor, Joseph Gobinson; Cashier, W. H. Oakley; Train Master, T. E. Clarke; Master Mechanic, R. Williams; Road Master, Charles Bender. No appointment of Superintendent has been made, but it is believed that Mr. Palmer will retain that position.

—Mr. T. G. Gorman's appointment on the Missouri, Kansas & Texas Railway is as General Master Mechanic, with office at Parsons, Kan., not at Denison, Tex., as was heretofore stated. Mr. Gorman succeeds Mr. F. Gould, who has resigned.

—At the annual meeting of the New Castle & Frenchtown Railroad Company, May 14, A. C. Gray was chosen President, with the following directors: S. M. Felton, Isaac Hinckley, G. H. Parser, R. J. Mercer, Wm. Sellers, S. Welsh, A. C. Rowland, S. Harlan, Jr., Jesse Lane, Thomas Kelso, Thomas Donaldson, Enoch Pratt. The board chose Alfred Horner, Secretary and Treasurer.

—Mr. N. V. Sisson, late Superintendent of the Chicago & Paducah, has been appointed General Superintendent of the Chicago, Pekin & Southwestern Railroad, in place of Gen. N. J. T. Dana, who went recently to the Quincy, Alton & St. Louis.

—Mr. Charles H. Chappell, for several years train dispatcher and train master on the Chicago, Burlington & Quincy Railroad, afterwards Superintendent of the Lodge Pole Division of the Union Pacific when Colonel Hammond was General Superintendent, and for the last two or three years Assistant Superintendent of the Chicago, Burlington & Quincy, has accepted an appointment as Superintendent of Transportation of the Missouri, Kansas & Texas Railway.

—Messrs. Samuel Sloan, President of the Delaware, Lackawanna & Western, and Marcellus Massey, President of the Rome, Watertown & Ogdensburg Company, have been chosen directors of the Lake Ontario Shore Railroad Company, to fill vacancies made by resignation.

—Mr. James A. Millholland, Second Vice-President of the Consolidation Coal Company, will hereafter have charge of the Cumberland & Pennsylvania Railroad as General Superintendent, in place of C. Slack, resigned.

—Mr. J. Johann, master mechanic of the Chicago & Canada Southern and the Toledo, Canada Southern & Detroit Railroads, has resigned. The whole operating department is now consolidated under the name of the Canada Southern Railroad Line, with Mr. C. E. Benton in charge of the machinery department. His headquarters to be at St. Thomas, Ontario.

—At the annual meeting of the United New Jersey Railroad & Canal Company in Trenton, N. J., May 26, the old board of directors was re-elected, as follows: William G. Cook, Benjamin Fish, John C. Stevens, Robert F. Stockton, Trenton, N.J.; Ashbel Welch, Lambertville, N. J.; A. L. Dennis, Nehemiah Perry, Newark, N. J.; Isaac W. Scudder, Jersey City, N. J.; Samuel Welsh, Philadelphia, Pa.; Hon. Hamilton Fish, Washington; John Jacob Astor, Cambridge Livingston, New York. The State director, appointed last February, is Charles A. Butts, Burlington, N. J.

—At the annual meeting of the New Jersey Midland Railroad Company in Jersey City, N. J., May 26, the following directors were elected: R. P. Terhune, I. N. Gamewell, Hackensack, N. J.; Garret A. Hobart, J. W. Hewson, J. W. Schermerhorn, E. Theodore Bell, Paterson, N. J.; C. A. Wortendyke, Wortendyke, N. J.; E. P. Wheeler, H. R. Low, Middletown, N. Y.; Samuel J. Tilden, Hezekiah Watkins, New York City; Dewitt C. Littlejohn, Oswego, N. Y.; S. E. Olmstead, Norwalk, Conn. The changes from last year are in the election of Messrs. Gamewell, Schermerhorn Bell, Tilden and Olmstead in place of Delos E. Culver, C. Vrecland, J. N. Pronk, E. C. Alburtis and J. Loomis.

—The Visalia Branch Railroad Company has been organized by the election of the following directors: S. A. Shepherd, Tipton Lindsay, Sol. Sweet, E. Jacobs, R. E. Hyde, S. C. Brown, John Cutler. The board elected J. W. Cowley Treasurer and H. Hertz Secretary. The office is at Visalia, Cal.

PERSONAL.

—Mr. C. Slack has resigned his position as General Superintendent of the Cumberland & Pennsylvania Railroad, after being connected with the road for more than 20 years.

—Mr. Rush R. Sloane, whose embezzlements while President of the Cleveland, Sandusky & Cincinnati Railroad Company and subsequent flight to Belgium have been recorded, has, it is said, entered into negotiations for a settlement with the company. The company, it is reported, has settled the civil suits, on payment of $250,000 by Sloane. A correspondent reports a plan to save Sloane's bail of the most of their bonds. Sloane is under indictment on 17 charges of embezzlement and four of forgery, in which bail is $46,000. The plan is, it is said, for him to return and have the bail reduced to $10,000, when he will run away again.

—*Engineering* of May 15 says: "Mr. Samuel Woodson, an American engineer and railroad builder, has arrived at Marseilles *en route* for India, where he is to meet the second son of M. de Lesseps, and join him in his surveying labors in connection with the proposed Central Asian Railway.

—Mr. F. W. Bowen, formerly Superintendent of the Sacramento and Oregon Division of the Central Pacific, and since December last General Superintendent of the Missouri, Kansas & Texas Railway, has resigned his position, his resignation to take effect June 1.

TRAFFIC AND EARNINGS.

—The following ocean shipments were made from New York during the week ending May 21: 25,622 bbls. flour, 1,370,666 bush. wheat, 347,886 bush. corn. From Baltimore and Philadelphia, for the week ending May 16, these shipments were: 12,707 bbls. flour, 251,600 bush. wheat and 351,590 bush. corn.

—The grain receipts of the six lake ports (Chicago, Milwaukee, Duluth, Detroit, Toledo and Cleveland), for the week ending May 16, and for 1874 ending with that date, were:

	Week.	Year.
Flour, bbls.	124,691	2,395,456
Wheat, bush.	1,513,382	24,980,869
Corn	1,052,186	16,329,934
Oats	569,130	8,036,753
Barley	19,300	2,084,755
Rye	15,223	588,888

The total grain receipts at these points were 52,590,219 bushels in 1874, against 38,688,490 in 1873, 34,138,868 in 1872, and 30,344,591 in 1871.

—During the week ending May 16, of the grain shipment from the six lake ports which ship grain nearly one-half of the flour, one-sixth of the wheat, two-elevenths of the corn, nearly half of the oats, nearly all the barley and one-fifth of the rye were dispatched by rail; the remainder by lake.

—Of the grain receipts at seaboard ports, for the week ending May 16, New York received 37 per cent. of the flour, 75 per cent. of the wheat, 59 per cent. of the corn and 76 per cent. of the oats. Those receiving the next largest proportion of each were: Boston, 15 per cent. of the flour; Montreal, 15 per cent. of the wheat; Baltimore, 16 per cent. of the corn; New Orleans, 8½ per cent. of the oats.

—During the first five years since the completion of the Central Pacific Railroad, which ended May 10, the San Francisco *Bulletin* says that the railroad brought to that city 177,500 through passengers and carried away 109,000, a total of 286,500. The freight statistics are wanting for the first nine months, but for the remaining four and one-quarter years the shipments of through freight eastward amounted to 126,117 tons, or 12,612 car loads.

—The earnings of the Great Western Railway of Canada for week ending May 8, were: 1874, £21,965; 1873, £25,585; decrease, £3,620, or 14⅛ per cent.

—The earnings of the Grand Trunk Railway for the week ending May 9 were: 1874, £42,200; 1873, £38,200; increase, £4,000, or 10½ per cent.

—The Receiver of the Southern Minnesota Railroad reports the earnings and expenses of that road for the three months ending March 31 as follows:

The receipts were:	1874.	1873.
From freights	$126,768 93	$66,291 66
From passengers	15,899 61	9,983 65
From express and mails	4,121 88	3,754 69
From all other sources	15,926 86	3,591 49
Total earnings	$162,717 28	$83,621 49
The expenses were:		
Conducting transportation	$57,345 54	$48,029 76
Repairs of engines, cars and machinery	18,341 03	20,788 90
General expenses	10,053 89	5,611 51
Maintain'g way, structures and telegraph	17,457 70	20,283 66
Snow shoveling	3,631 77	13,971 64
Total expenses	$106,428 92	$108,685 47

The net earnings in 1874 were $56,288.36, against a deficiency of $25,063.98 in 1873. The expenses were 65 per cent. in 1874 and 130 per cent. in 1873. The gross earnings were $971 per mile in 1874 and $499 in 1873, an increase of 48⅝ per cent.

—The Receivers of the New York & Oswego Midland Railroad give the following statement of the earnings and expenses from September 18, 1873, the date of their appointment, to March 31, 1874:

	Miles.	Earnings.	Expenses.	Loss.
September (12 days)	551	$65 018 27	$87,398 65	$22,380 38
October	551 & 514½	127,643 05	201,622 17	74,049 12
November	514½ & 477	116,914 03	138,794 97	21,880 94
December	477 & 450½	88,684 16	113,269 46	24,585 30
January, 1874	436½	71,475 32	107,626 40	36,151 08
February	436½	69,690 67	90,969 56	21,278 89
March	436½	73,762 54	91,799 31	18,036 77
Totals		$613,188 04	$831,550 52	$218,362 48

For the four months ending April 30, the receipts and expenses were as follows, as compared with those for the same period in 1873, when the company was working the road:

	1874.	1873.	Decrease.	Per ct.
Earnings	$.94,950 73	$350,005 11	$55,054 38	15⅝
Operating expenses	375,252 38	654,572 86	279,320 48	42⅝
Loss	$80,301 65	$304,567 75	$224,266 10	73⅝

The average mileage worked in 1874 was 427 miles, and in 1873, 499 miles. The net *loss* per mile operated was, in 1874, $46.27, and in 1873, $155.39. The operating expenses were 127.23 per cent. of receipts in 1874, and 187.02 per cent, in 1873.

—The earnings of the Great Western Railway of Canada for the week ending May 1 were: 1874, £24,832; 1873, £25,025; decrease, £193, or 0¾ per cent.

—The earnings of the Grand Trunk Railway for the week ending May 2, were: 1874, £39,300; 1873, £38,000; increase, £1,300, or 3⅜ per cent.

—The earnings of the lines operated by the Central Vermont Company for the six months ending December 31, 1873, were:

Earnings ($3,717 per mile)	$2,441,993 22
Expenses (70.03 per cent.)	1,710,028 04
Net earnings ($1,114 per mile)	$731,965 18

—The earnings of the Chicago & Northwestern Railway for the second week in May were: 1874, $255,482; 1873, $247,025; increase, $8,457, or 3⅜ per cent.

—The earnings of the Rockford, Rock Island & St. Louis Railroad for the month of March were:

Passengers	$22,505 43
Freight	53,650 33
Mail and miscellaneous	4,160 09
Totals earnings ($290 per mile)	$80,315 85
Expenses and taxes (74.95 per cent.)	60,199 92
Net earnings ($73 per mile)	$20,115 93

—The earnings of the Mineral Range (narrow-gauge) Railroad for April were:

Passengers	$3,203 60
Freight	3,857 20
Total earnings ($565 per mile)	$7,060 80
Operating expenses (59.96 per cent.)	4,233 30
Net earnings ($2.6 per mile)	$2,827 50

—The coal traffic of the Pennsylvania Railroad for the second week in May was as follows:

Anthracite (tons of 2,000 lbs.)	6,768
Bituminous	61,302
Coke	11,099
Total	79,159
Danville, Hazleton & Wilkesbarre (anthracite)	1,711
Total	80,870

—The earnings and expenses of the Toledo, Wabash & Western Railway for the four months ending April 30 are reported as follows:

	1874.	1873.	Increase.	Decrease.	Per c.
Earnings	$1,668,038 23	$1,693,228 21	.....	$ 25,189 98	1½
Expenses	1,121,780 49	1,335,863 80	.....	214,083 31	16
Net earnings	$546,257 74	$357,364 41	$188,893 33	.....	52⅞

The earnings per mile in 1874 were $2,612, and in 1873, $2,652. The expenses were 67.25 per cent. of earnings in 1874, and 78.89 per cent. in 1873.

—The net earnings of the Philadelphia & Erie Railroad for the first four months of the year are reported as follows:

	1874.	1873.	Increase.	Per c.
January	$46,052	$32,140	$13,912	43¼
February	48,590	48,508	82	0¼
March	65,226	23,762	41,464	174½
April	42,886	26,786	16,100	60⅛
Total	$202,760	$131,196	$71,564	54½

The decrease in the expenses in 1874 was $379,764, and in gross earnings $308,200.

—The earnings of the Chicago, Milwaukee & St. Paul Railway for the third week in May were: 1874, $204,200; 1873, $178,239: increase, $25,961, or 14⅝ per cent.

THE SCRAP HEAP.

Railroad Manufactures.

A company with $80,000 capital has been organized to build a rolling mill in Ashtabula, O.

The Troy (N. Y.) Steel Works stopped work May 16, and will remain closed until further notice.

The Phœnix Iron Company has nearly completed a new rolling mill at Phœnixville, Pa., which is believed to be the largest mill building in the country. It covers 6¼ acres of land.

The Wason Company's works at Springfield, Mass., have

just completed a number of cars for the Connecticut Western and Housatonic railroads.

The Lackawanna Iron & Coal Company at Scranton, Pa., has suspended work and closed all its shops for the present. The cause a ated is the continued depression in the iron market and the impossibility of selling the product of the works.

The Harrisburg Car Manufacturing Company has resolved to suspend work until there is substantial evidence of a revival of business.

The rail mill of Harbaugh, Matthias & Owens at Pittsburgh has been closed. It is uncertain when work will be resumed.

The Fairbanks Scale Company at St. Johnsbury, Vt., is making 24 500-bushel hopper scales for the elevators of the Baltimore & Ohio Railroad Company at Locust Point, near Baltimore.

The Birmingham Iron Works at Birmingham, Conn., have concluded a contract with the Union Pacific Company for the erection of a rolling mill on the line of that road.

Seath & Hager's car works at Terre Haute, Ind., will soon start up with a small force on orders for the Evansville & Crawfordsville and Evansville, Terre Haute & Chicago roads.

The Watson Manufacturing Company at Paterson, N. J., has just completed a suspension bridge of 130 feet span for the Rio Cuilo in Peru. A Post truss bridge of 150 feet span is being built for the European & North American Railroad, to cross the Mattawamkeag River.

The Westinghouse Brake in Belgium.

The *Moniteur Industriel Belge*, a new Belgian technical journal, says that the administration of the Belgium State Railroads is now making experiments with the Westinghouse air-brake.

What English Locomotive Men Want.

A memorial, which it is stated has been signed by upwards of 400 drivers and firemen of the London & Southwestern Railway, has just been presented to the directors of that company, in which the memorialists ask for the following among other concessions: "That all enginemen and firemen be paid at the rate of ten hours a day; that each day stand by itself; that no man be required to go on duty for less than a day's pay, and receive not less than six days' wages per week unless on leave of absence or unable to work through sickness; that all overtime be paid for at the rate of eight hours per day, and commence after ten hours' duty; that all time worked between twelve o'clock midnight on Saturday and twelve o'clock midnight on Sunday be paid for at the rate of eight hours per day; that men on passenger trains shall not run more than 160 miles, and men on goods trains not more than 100 miles for a day's wages; and that work performed after this number of miles is run, or after ten hours' duty, be considered overtime and paid for as such; that the hours of duty for shunting enginemen and firemen be twelve per day, out of which two hours shall be allowed for meals, all overtime and Sunday work to be paid for at the rate of eight hours per day; that as far as practicable nine hours be the minimum time off duty; that all enginemen be paid at the following rate: First six months, 5s. 6d. per day; second six months, 6s. 6d.; after one year, 7s.; and after five years, 7s. 6d. per day; that the following be the rate of wages for firemen: For the first year, 3s. 6d. per day; for the second year, 4s.; after the third year, 4s. 6d.; and when required as enginemen, 5s. 6d. per day." The other parts of the memorial relate to shed work, promotion by seniority, lodging allowance, overcoats, and terms of leaving the service; and in conclusion the memorialists state "they are not unmindful of the kind treatment they have ever received at your (the directors') hands, and trust that, as it is their aim to do their duty satisfactorily, they will succeed in obtaining your approbation and esteem."

The seven shillings asked for full engine-drivers is equivalent to just about $1.90 in our currency. The fireman's pay asked is $1.21 for men of three years' service.

OLD AND NEW ROADS.

Cincinnati, Sandusky & Cleveland.

Dispatches state that President Farlow has finally negotiated a settlement of the civil suits with Sloane on a basis of $250,000 and has received deeds to property and other securities, which, with proper management, will cover the sum stolen from the company.

Meetings.

The following companies will hold their annual meetings at the times and places given:

Canton Company (which owns the Baltimore Union Railroad) at Baltimore, Md., June 4, at 11 a. m.

Baltimore & Drum Point in Baltimore, June 3.

Chicago, Milwaukee & St. Paul in Milwaukee, Wis., June 13, at 12 noon.

Atlantic & Pacific (adjourned from May 21) in New York, June 25.

Chicago & Northern Pacific Air Line, at No. 87 East Washington street, Chicago, June 11, at 10 a. m.

St. Louis, Alton & Terre Haute in St. Louis, June 1, at 3:30 p. m.

Chicago & Alton.

Notwithstanding the writ of *certiorari* from the United States Circuit Court the Sangamon County Court resolved to go on and try the suit of the Illinois Railroad Commissioners. The company's attorneys offered to allow a judgment by default provided they were allowed to have a record in the case on which to appeal to the Supreme Court. This was refused and the case proceeded to trial, resulting in a judgment of $3,000 against the company. There will certainly be some contest as to the jurisdiction of the court.

Sioux City & Kearney.

Meetings are to be held to advocate the construction of this road, which is to extend from Sioux City, Ia., southwest to Kearney Junction on the Union Pacific, and will be about 200 miles long.

Orange & Bolivar Point.

This company has been chartered by the Texas Legislature to build a railroad from Orange, Tex., southwest by way of Sabine Pass to Bolivar Point, opposite Galveston, a distance of about 90 miles. The capital stock must not exceed $3,000,000, nor the issue of bonds $40,000 per mile. The company is to have a land grant of 16 sections of land per mile if the road is of standard gauge, or 12 sections if it is a narrow-gauge road.

Wisconsin Railroad Law.

Governor Taylor has issued a circular in which, after reciting the resistance of the Milwaukee & St. Paul and Chicago & Northwestern railroad companies to the law recently passed by the Legislature fixing tariffs for the transportation of freight, he urges every citizen to pay only the amounts the law prescribes for the services of these roads, and if they exact more to make complaint of such violations before justices of the peace, and have them come up to the higher criminal courts. He requests all district attorneys to prosecute the roads if any such complaints reach them.

Criminal suits against both the Chicago & Northwestern and Milwaukee & St. Paul companies for collecting fares in excess of those allowed by law have been commenced in the Dane County courts.

Hoosac Tunnel Line.

The discussion of the Hoosac Tunnel question in the Massachusetts Legislature seems to have fairly opened, and promises to be nearly as long as last year's debate. The leading plans are that of the majority of the railroad committee, which contemplates a consolidation of all the roads included in the tunnel line under a board of trustees in which the State is to have a majority, and the minority bill, which provides that the State shall remain owner of the tunnel and the Troy & Greenfield road and hold them open to the traffic of any railroad which may wish to connect with them.

The Railroad Committee has recommended an appropriation of $3,000,000 for the purpose of finishing up the tunnel and making certain improvements on the Troy & Greenfield road.

Canada Pacific.

The plans for the western end of the road include about 240 miles of road on Vancouver Island and a mile an a half of bridging on the narrows between that island and the mainland; two spans of 1,350 feet, one span of 1,200 feet, three spans of 1,100 feet and one span of 540 feet. In addition to this bridge there would be required some very heavy rock work, including several tunnels 3,000 feet or so in length. Much opposition is made to this plan and the Canadians are beginning to think that the agreement with British Columbia will be carried out when the road reaches deep water on the Pacific without building the Vancouver Island line, which is sure to be very costly and very unproductive.

Port Dover & Lake Huron.

A contract has been let for the grading and bridging of this road for the sum of $315,000. It will be about 60 miles long, from Port Dover, Ont., on Lake Erie, north by west to Stratford on the Grand Trunk. A part of the line was graded some years ago by the Woodstock & Lake Erie Company. The company has $205,000 in township and county aid and a subsidy of $2,000 per mile from the Ontario Government. The capital stock is $100,000, and it is proposed to issue $10,000 per mile in bonds. The harbor at Port Dover is owned by the company.

Missouri, Kansas & Texas.

Upon the retirement of General Superintendent Bowen, June 1, the office of General Superintendent will be abolished. The immediate charge of operating the road will rest on a Superintendent of Transportation, acting under orders from the General Manager. The division organization will remain the same as at present.

Chesapeake & Ohio Canal.

In the heading of an item last week, stating that this company had ordered the payment of the coupon due July, 1859, on the preferred construction bonds, the word "Canal" was accidentally omitted, making the item read as if referring to the Chesapeake & Ohio Railroad, instead of the Canal Company.

Clarkesville & Petersburg.

It is proposed to build a railroad from Clarksville, Va., northeast to Black's-and-White's Station on the Atlantic, Mississippi & Ohio. The road would be about 50 miles long and would be parallel to and some 20 miles eastward of the Richmond & Danville road.

Conestoga Valley.

At a meeting held in Churchtown, Lancaster County, Pa., recently, it was resolved to let a contract for the construction of the road from Churchtown in the Conestoga Valley to the Falls of French Creek, a distance of about 12 miles. A committee was appointed to confer with the Pennsylvania & Delaware Company on the question of consolidating the two companies.

Valley, of Virginia.

The work on the grading in Botetourt County, Va., is progressing from Buchanan northwest to the Rockbridge line. One contractor is at work southwest of Buchanan and another is about to commence on his work.

Chicago & Northwestern.

A much-needed improvement is being made on the Winona cut-off by the filling up of the long trestlework east of the Winona Bridge, which has been somewhat shaky for some time. Two trains and a steam shovel are at work and the filling goes on rapidly. The embankment is to be riprapped to prevent washing in times of high water.

Michigan & Ohio.

This company talks of building a railroad from Grand Haven, Mich., southeast to Portsmouth, O., about 450 miles, passing through Defiance, Columbus and Chillicothe. It has some engineers in the field, making surveys near Lima, O.

Middleboro & Taunton.

The stockholders have voted to accept the act of the Legislature authorizing a transfer of the road to the Old Colony Company and have ordered the execution of the necessary deeds for the transfer.

St. Louis, Iron Mountain & Southern.

A new transfer house 300 by 40 feet is being built at Texarkana, and the car-hoist, for changing the cars on to trucks of another gauge, is very nearly ready for use. The stock yards at that point can accommodate 1,800 cattle.

Winona & St. Peter.

The Attorney General of Minnesota has brought suit for the State to recover about $65,000 taxes and interest alleged to be due from this company. The sum sought to be recovered is the difference between the 3 per cent. on gross earnings fixed by the charter and the lower rate of taxation fixed by a later law, which has since been decided unconstitutional.

For some months no regular trains have been run over the 80 miles of road from Marshall, Minn., west to Lake Kampeska, Dak., the western terminus. Recently an intimation was received from the Railroad Commissioners that regular trains ought to be run to the State line, and preparations are being made to reopen the road. The Roadmaster, Mr. Hanley, was sent out from Marshall to ascertain the condition of the track, and started with a party of men and three days' stores on a hand car provided with a large sail, by the aid of which he expected to make the trip with little labor.

San Francisco & North Pacific.

The shops at Donahue, Cal., recently burned, are being rapidly rebuilt. A new storehouse has also been erected. The equipment has been increased by two locomotives from the works of Booth & Co., in San Francisco.

Rockford, Rock Island & St. Louis.

This company has been carrying grain from Rock Island to St. Louis for 10 cents per 100 pounds, and flour at 20 cents per barrel. Further, the contracting agent in St. Louis threatens to take freight from St. Louis to St. Paul at 15 cents per 100 pounds, going by river from Rock Island to St. Paul. Competition with the river is the cause of these low rates.

Western Illinois Bridge.

This company has let the contract for the bridge, which it proposes building across the Mississippi at Quincy, Ill., to the American Bridge Company, of Chicago. The contract includes the approaches. The terms are not made public.

Terre Haute & Indianapolis.

An agreement has been made with the Indianapolis & St. Louis Company which is intended to do away with competition for the business between St. Louis and Indianapolis. The roads are to be worked together, and the earnings will be pooled and divided equally between the two companies.

Alabama & Chattanooga.

A dispatch published in New York papers of May 27 says that Gov. Lewis of Alabama, under authority given him by the Legislature at its last session, has sold this road to A. P. Balch, of Hanover, N. H., as representative of a company of New England capitalists. The road is now in the hands of receivers appointed by the United States Circuit Court in a foreclosure suit, and is to be sold at foreclosure sale June 15. The sale intended is possibly of the State's interest in the road.

Illinois & St. Louis Bridge.

The difficulties between the company and the contractors have been adjusted and the company put in possession of the bridge. The bridge was opened for foot passengers May 23 and will be ready for vehicles about June 8. Workmen are now laying the railroad tracks across the bridge and through the tunnel at the western end, but no date has been set for the passage of trains.

New York & Oswego Midland.

A meeting of first mortgage bondholders was held in Utica, N. Y., May 26, over $1,000,000 of bonds being represented. A committee of five was appointed to inquire into the various plans of reorganization proposed, to select one of them, or any other plan which may be thought best, and submit the same by circular to the bondholders. The committee is composed of the following bondholders: James W. Clarke, Oxford, N. Y.; John T. White, New Berlin, N. Y.; E. H. Risley, Utica, N. Y.; Charles G. Burke, Little Falls, N. Y.; Clarkson T. Collins, Great Barrington, Mass. The committee has appointed a meeting to be held at the Windsor Hotel, New York, June 16.

The company has commenced running a through train from New York to Oswego and Utica. It leaves New York over the New Jersey Midland at 6 A. M.

North Carolina.

Mr. Thomas Branch, of Petersburg, Va., a large holder of the stock and also of the original construction bonds, has obtained an injunction restraining the officers of the company from completing the consolidation with the Western North Carolina and Atlantic & North Carolina companies. The main point in the complaint was that the company was bound to receive or reject the consolidation act as a whole, and could not, as it has tried to do, accept some of the provisions of the act and reject others.

Central Branch, Union Pacific.

In the controversy between this company and the Kansas Pacific involving the title to some 74,000 acres of land in Jackson, Pottawattomie and Riley counties, Kansas, the Interior Department after a re-hearing has confirmed its former decision granting the lands to the Central Branch Company.

Dividend.

The St. Louis, Alton & Terre Haute Railroad Company has declared a dividend of 3 per cent. on the preferred stock, payable July 6.

Martha's Vineyard.

The contract for the construction of the Martha's Vineyard Railroad has been let to Dacy Brothers, who agree to have the line completed by July 20. The road will run across the island of Martha's Vineyard from Oak Bluffs through Edgartown to Katama, and will be about 12 miles long.

Boston & Maine.

The switch completing the connection between the Boston & Maine and Grand Trunk roads on Commercial street, Portland, Me., was finally laid May 24. The famous frog, over which there has been such a long controversy, was at last laid without any opposition from the Eastern Railroad people. The Boston & Maine passenger trains will hereafter run up to the Grand Trunk depot.

Visalia Branch.

This company has been fully organized and 10 per cent. of the stock paid in. Work is to be begun at once, and it is intended to have the road completed by July 1. The road will be seven miles long from Visalia, Cal., to the nearest point on the Visalia Division of the Central Pacific.

Stockton & Ione.

Work on the grading was commenced near Stockton, Cal., May 7. The contractor has a small force at work, which will be increased as fast as possible.

Santa Clara & Alviso.

It is proposed to build a narrow-gauge road from Santa Clara, Cal., northwest to Alviso, near the southern end of San Francisco Bay, a distance of about ten miles.

Lee & New Haven.

The lower house of the Massachusetts Legislature has voted in favor of reviving and renewing the State grant of $300,000 in aid of this road, which lapsed some time since, and the friends of the road are confident that the bill will pass both houses. This State aid will be pretty sure to secure the building of the road.

Eastern.

It is reported that a large party among the stockholders is opposed to the present management and intends to make trouble hereafter.

Several conductors have lately been discharged, and it is stated that the company has lost heavily by stealing among those employes.

New Jersey Southern.

Some of the first-mortgage bondholders having asked to be made plaintiffs with the trustees in the foreclosure suit now in progress, the Chancellor of New Jersey has refused the application. He has, however, granted them leave to come into the suit as defendants and has directed that a supplementary bill be filed stating the claims of the bondholders under the first mortgage to the Long Branch & Sea Shore road and certain other property, the ownership of which is disputed. The trustees continue to hold the Long Branch road as part of the New Jersey Southern, pending the decision of the Court.

Montreal, Chambly & Sorel.

The road has been finally located from West Farnham, Quebec, southeast through Riceburg and Stanbridge East to Frelighsburg. Contracts are to be let at once and grading will soon be begun on this section.

Southeastern, of Canada.

The trains on this road, which have heretofore run over the Passumpsic road from Newport, Vt., to Derby Line and thence over the Stanstead Branch to Stanstead, will hereafter run only to Newport. The Stanstead Branch will be worked by the Connecticut & Passumpsic Rivers Company.

North & South of Georgia.

The Governor of Georgia has taken possession of this road in consequence of the failure of the company to pay the interest on the State bonds issued in aid of the road. Dr. Llewellen has been put in charge of the road as Receiver.

Whitewater Valley.

On application of the Indianapolis, Cincinnati & Lafayette and Ohio & Indiana companies, the Cincinnati Court of Com-

mon Pleas has issued a temporary injunction to restrain the Whitewater Valley road from running contrary to the contract with the plaintiffs. The action is taken in consequence of the transfer of the Cincinnati business from the Indianapolis, Cincinnati & Lafayette to the Ohio & Mississippi road.

Buffalo Valley.

This road, from Berlin, Pa., southwest to the Pittsburgh, Washington & Baltimore, near Garrett's, is progressing rapidly and will, it is expected, be completed this month.

Lafayette, La Salle & Clinton.

At the annual meeting in La Salle, Ill., recently, the surveys and estimates for the road were submitted. The length of the road as surveyed is 120 miles and the estimated cost $2,188,000.

Washington & Ohio.

Adams, Hamner & Co., of Lynchburg, Va., having completed their contract on the line from Lynchburg to Danville, have commenced work on the extension of the Washington & Ohio road from Purcellville, Va., to Round Hill.

Blue Ridge, of Missouri.

This road is to extend from the Atlantic & Pacific at Hancock, Mo., northward through Pulaski and Maries counties to the Crismin Iron Bank. The surveys are nearly completed and grading will soon be commenced. It will be 12 miles long, and it is intended to finish it this season.

Memphis & Raleigh.

The county court of Shelby County, Tenn., has applied for an injunction to restrain this company from selling any of the $50,000 of county bonds voted to it, and also for an order to compel the company to render an account of the disposition made of the proceeds of the bonds already sold. The ground of the application is that the road has not been completed into Memphis as agreed, but only to the crossing of the Louisville & Nashville road.

Port Norris & Millville.

A company is to be organized to build a railroad from Port Norris, N. J., north to Millville on the West Jersey road, a distance of about 14 miles. One man has agreed to subscribe to the stock one-half the amount needed to build the road.

Cincinnati Southern.

Nearly all the contractors on the sections let in Tennessee have begun work. The largest contracts on this section were let to M. Lineback, of Cincinnati, and McCabe Brothers, of Havre de Grace, Md. The work on these sections is to be finished in 14 months.

East Tennessee, Virginia & Georgia.

In the Circuit Court at Morristown, Tenn., one P. A. Shearer has brought suit to recover $250,000 from this company under a law which provides that on passenger trains the name of the station and the length of the stoppage shall be announced in a loud voice at each station. The penalty for each violation of the law is $100, one-half going to the informer and one-half to the school fund. Shearer has traveled on the road until he has noted 2,500 violations of the law, and now brings suit for the penalty.

Chicago & Paducah.

This company has just completed its telegraph line along the line of the road from Streator, Ill., to Windsor, 128 miles.

The company has been somewhat delayed in completing the extension southward from Windsor by difficulty in getting the right of way for a mile and a half of the road in Effingham County. The owners have refused to sell the right of way at any price, and an injunction has been obtained to prevent any work being done on the land in question. A subscription of $200,000 had been voted by Moultrie County, on condition that the road should be completed to Altamont by May 28, and it is believed that this trouble is caused by parties who wish to have the subscription forfeited. It was believed that the right of way could be obtained without difficulty until it was too late to begin proceedings for its condemnation.

Blue Ridge.

The bankruptcy sale, which was to have taken place May 14, has been postponed to Oct. 22 by order of the Court.

St. Joseph & Denver City.

The United States Circuit Court has granted the company permission to sell any of the mortgage lands not needed for the operation of the road. The sale must be only for cash, bonds or coupons, and the purchase money must be paid to the trustees. On such payment being made the company may make a deed.

Southern Minnesota.

A number of gentlemen, representing all classes of bondholders, the floating debt creditors and the stockholders, have been holding an informal conference in St. Paul for the purpose of devising some plan for the adjustment of the difficulties of the company.

Lafayette, Muncie & Bloomington.

It is stated that at a recent meeting of the directors a contract was let for the extension of the road from Lafayette, Ind, east by south to Muncie, a distance of about 85 miles.

New York & Canada.

The road is ready for the iron from Whitehall, N. Y., to Ticonderoga, except at one or two places where heavy fills are needed. A large force is employed.

An attempt is being made to prevent the issue of the bonds voted to the road by the town of Whitehall.

Frankford & Breakwater.

The iron and ties for the road from Millsboro, Del., to Frankford have been purchased, and the grading is going ahead rapidly. The contractors have 250 men at work.

Windsor & Forest Line.

At the annual meeting in Greenfield, N. H., recently, the directors reported that the estimated cost of the road is $1,800,000. Of this it is proposed to raise $500,000 by stock subscriptions, $200,000 by town votes, $270,000 by payment of stock to contractors and $830,000 by sale of convertible bonds. The plan was adopted by the stockholders. The road will run from Greenfield, N. H., northwest to Windsor, Vt., and will be about 55 miles long.

Chicago & Canada Southern.

A correspondent of the Chicago *Inter-Ocean* writing from Grosse Isle, Mich., under date of May 16 says, with regard to the completion of this road:

"For some time negotiations have been pending with influential parties to this end, and at last I have the pleasure of writing you that the consolidated Canada Southern line is immediately to be furnished with money and material to construct the road from Fayette, Ohio, to Chicago. General J. S. Casement, the 'Lightning Track Layer,' the man who built the Union Pacific road, is to have charge of the construction, and, as stated above, will in a few days begin the rendezvousing of his army of employes here at Grosse Isle."

As to the route he says:

"The Canada Southern line at present extends and trains are being run to Fayette, Ohio, a distance of 86 miles from Trenton Crossing, leaving only 160 miles to be completed to land the road in Chicago. From Amherstburg, which is on the Canada bank of the Detroit River, the distance is divided as follows: 3,400 feet across the main channel of the Detroit River, service performed by the largest transfer steamer in the world, holding 21 cars; from pier over trestle, 2,000 feet; across Stony Point, ¼ of a mile; pier bridge (of wood), 923 feet; across Grosse Isle, 1 6-10th of a mile; across Michigan channel of Detroit River, 1,800 feet on pier bridge, including an iron draw of 300 feet; to Trenton Crossing, 2,500 feet.

"To reach Chicago from Grosse Isle the line will run through the counties of Wayne, Monroe and Lenawee, Mich., tapping the important towns of Carlton, Exeter, Dundee, Deerfield, Blissfield, Fairfield, Weston, Morenci and Fayette, the present terminus. From Fayette the line will strike into Williams County, Ohio; Steuben, Lagrange, Elkhart, St. Joseph, Laporte and Porter counties, Ind., entering Chicago between the lines of the Michigan Central and Pan-Handle roads. It will tap the towns of Montpelier, Hamilton, Steubenville, Goshen, Kankakee, Ind., cross the New Albany & Chicago road near Wanatah, and the Fort Wayne road near Valparaiso. The right of way into Chicago has not yet been secured, but it is more than probable that the Canada Southern will join the Illinois Central and Chicago, Burlington & Quincy in the erection of a mammoth passenger station on the lake front."

With regard to the advantage which its easy grades give he says:

"On Friday night Engine 18 brought 59 cars from St. Thomas to Amherstburg at the rate of fourteen miles an hour."

These were probably mostly empty, as is the case with all trains west-bound.

Michigan Central.

In reply to numerous applications for reduced rates on special occasions, the General Superintendent, Mr. H. E. Sargent, has issued the following circular:

"In reply to yours and the numerous applications for reduced rates of fare and freight, I beg to say that the arrangement of this company with other lines, and the practice for several years past, is to reduce only on the occasion of the Michigan State Agricultural Annual Fair. Any deviation from this rule invites innumerable applications from all points and for all purposes.

"We cannot reduce for all, and any discrimination in favor of the minority and against the majority of the applications could not fail to meet with disappointment and dissatisfaction; hence we find it necessary to adhere closely to the rule which we have adopted.

"On the occasion of the State Fair, we reduce on all our roads to half rates, and carry all animals and freight to and from the fair free, providing the animals or articles of exhibition do not change hands."

Ottawa, Oswego & Fox River Valley.

In a suit in which the validity of the municipal bonds issued in aid of this road was denied, by reason of informality in the manner of the passing of the bill authorizing them (the records of the Legislature showing but one reading, instead of the three required by law), Judge Blodgett, of the United States District Court in Chicago, held that it did not lie in the mouth of the defendant to question in this manner—and in a collateral proceeding—the validity of a law under which it had acted and obtained credit; that having held out to the world that the law in question authorized the issue of its bonds, the defendant is estopped from now denying the validity of that law by reason of any *secret* defect of the character referred to.

Maxwell Estate.

The holders of stock and bonds in this New Mexico land and railroad company, which seems to have been organized for the purpose of borrowing money without any consideration of the ways and means of paying the interest or principal, held a meeting in Amsterdam, where nearly all these "securities" are held, on the 27th of April, at which a committee was appointed to negotiate with the corporation concerning a settlement of the debts, with authority to foreclose the mortgage. The meeting blamed the firm which sold the securities for the company.

American Bonds in Europe.

Quotations in Frankfort, May 9, were: Alabama & Chattanooga 8s, 18⅝; Buffalo, New York & Philadelphia 6s, 62; Cairo & Vincennes 7s, 48⅝; California Pacific Extension 7s, 30¾; Central Pacific 6s, 78⅛; San Joaquin Valley 6s, 59; Chicago, Burlington & Quincy 4½ s, 71; Grand Rapids & Indiana 7s, 88½; Missouri Pacific 6s, 85⅝; Mobile & Ohio 7s, 78½; Oregon & California 7s, 15⅝; Rockford, Rock Island & St. Louis 3½s, 15½; St. Louis & Southeastern 7s, 37⅛; Union Pacific Eastern Division 6s (Kansas Pacific), 51⅞; Omaha Bridge 8s, 70.

At Berlin May 8th quotations were: Chicago & Southwestern 7s, 65; Kansas Pacific 7s, 41; Port Royal 7s, 20½.

At Amsterdam on the 7th of May: Maxwell Estate 7s, 15⅝; Chicago & Northwestern 7s, 76½; St. Paul & Pacific 7s, 14; Kansas Pacific 7s, 41⅜; Atlantic, Mississippi & Ohio 7s, 33⅛; Missouri, Kansas & Texas 7s, 41¼; Cairo & St. Louis 7s, 38.

Rio Grande, of Brasil.

This railroad is one which the Brazilian Government has under construction from Porto Allegre, the capital of the province of Rio Grande (the southernmost province of the empire), westward up the valley of the Rio Pardo a distance of about 200 miles to the borders of Uruguay. Mr. H. V. F. Penna, a Brazilian engineer, who is one of the contractors for the construction of this road, has been in the United States purchasing rolling stock, etc., for the road. American rolling stock will be used altogether on the road, as it is on some other Brazilian roads, which have been built for the most part by the Government itself, though the first were built by English companies. The Rio Grande is a line which presents no unusual difficulties in construction, being in the river valley throughout its length.

Vera Cruz & Mexico.

The hostility of the Council of Foreign Bondholders has prevented the negotiation of securities in Mexico for works of any new companies, but it was withdrawn in favor of a loan of £260,000 issued by the Mexican Railway Company, for the purpose of constructing a line from Vera Cruz to Jalapa. Work is now in progress on this line, which the company promise to complete within a few months. The line extends nearly due northwest from Vera Cruz, at an angle of about 60 degrees with the line to Mexico, and will be about 70 miles long.

The Mexican Railroad Contract.

The *Two Republics* of May 10 announces the forfeiture of the railroad concession to the "fourteen merchants" as follows, without further comment:

"The concession granted by Congress in January last to the company of fourteen merchants and bankers of this city, for the construction of an international and interoceanic railroad, was declared forfeited before Congress on the 8th inst. by the Minister of Public Works." The same journal, under date of May 3, says that Congress has approved a contract made by the Executive with Messrs. Rendon Peniche and Pedro Contreras Elizalde for the construction of a railroad from Merida to Progreso, in the State of Yucatan, (about 18 miles.)

Lake Ontario Shore.

The agreement for the transfer of this road to the Rome, Watertown & Ogdensburg Company has been ratified by the latter company, but the transfer has not yet been made. Among the conditions of the agreement is one that the lessee is to complete the road to the Niagara River, if possible the present season; to connect the two roads by building a bridge over the Oswego River; to provide for the payment of the floating debt, and also to pay $78,000 now due for right of way west of the Genesee River.

The engineers of the Rome, Watertown & Ogdensburg Company are now making a careful examination of the completed part of the Lake Ontario Shore road, and also of the unfinished grading west of the Genesee.

Erie.

The New York *Bulletin* says that a circular proposing the election of a new board of directors for this company at the annual meeting next July, and asking each recipient to allow the use of his name as a candidate for that position, has been sent, during the last week, to a number of well known citizens. The circular purports to be issued in behalf of the foreign shareholders and bondholders of the Erie road, and those who receive it are requested to send their answers to "N. M. Rothschild & Sons," London, and to "Mortimer Livingston," New York Post-office. Is accompanied by a letter with the signature of John Livingston.

The circular does not appear to come from any recognized source.

Springfield & Illinois Southeastern.

The Frankfort *Zeitung* of May 11 says that the Austrian-German Bank has issued a circular inviting bondholders to send in their bonds for deposit with the Farmers' Loan and Trust Company in New York. It is desired to have the bonds deposited by June 1, when foreclosure proceedings are to be commenced.

Union Pacific.

The Land Department reports sales for April of 30,278.38 acres for $140,636.80, an average of $4.64 per acre. The total sales up to April 30 were 936,638.29 acres for $4,260,939.13, an average of $4.55 per acre. The land notes on hand amount to $2,369,785.04. The total issue of land-grant bonds is $10,400,000, of which $1,503,000 have been canceled by the Land Department and $552,000 by the trustees, leaving $8,345,000 outstanding.

In the United States Circuit Court at Des Moines, Ia., May 21, Judge Dillon issued an order requiring the company to appear and show cause why Council Bluffs should not be made the terminus of the road. The order is returnable at the next term of Court.

New York, New Haven & Hartford.

In New York, May 23, William Banker, who has been a conductor on the road for over 20 years, was arrested on a charge of defrauding the company of $50,000. He was committed for trial.

Long Island.

A suit to recover penalties amounting to $70,000 is pending in the Circuit Court at Riverhead, N. Y. The offense is a violation of a law which requires companies to provide a vessel of drinking water and cups in each car, the penalty being $10 for each failure to do so. The parties bringing the suit claim that their object is to compel the company to pay some attention to the comfort of passengers.

Connecticut Western.

The board of directors has resolved to build the proposed branch from Tariffville, Conn., northeast to Springfield, Mass., when money can be procured. The board also resolved to issue new stock at par for the amount required for the branch, but voted down a proposal to issue bonds at the rate of $10,000 per mile on the branch. A proposal has been made to build the branch, which will be about 16 miles long, for $529,000 ($33,000 per mile), that sum to cover everything but right of way and depot buildings.

Connecticut Central.

The charter of the Springfield & Longmeadow Company, which was to build the Massachusetts end of the line, having expired by limitation, a new company is to be organized under the general law, and another effort will be made to secure aid from the city of Springfield.

Lancaster & Reading.

A small force is at work finishing up the grading of the Quarryville Branch and making such changes in the road-bed as will fit it for the standard gauge, which will be adopted instead of the narrow gauge.

Detroit & Milwaukee.

The Detroit *Tribune* of May 23 says: "The holders of bonds have been urgently pressing their claims for the interest due them, and the company has been earnestly soliciting aid from the Great Western Railway of Canada, which virtually controls it. A board of examination was sent out from England last winter by the Great Western shareholders, who inspected the road and expected to make their report in England before this time. One of their number, however, fell sick in Canada before the party reached the seaboard, and by his illness the whole matter has been delayed. A meeting of the Great Western shareholders was recently held in London, at which the report of the examiners was expected to be presented. When it was found that it could not be obtained, the other business on nand was transacted and the meeting was left open for the presentation of the report at a future time. When the conclusions of the board are learned by the shareholders, they will quickly determine whether any assistance shall be rendered to the road or not. That conclusion ascertained, the bondholders and other creditors of the line will act accordingly. Meanwhile the pending claims and suits will be held in abeyance. It is probable that a month or two will bring about some definite result."

Kentucky Central.

An attempt is being made to arrange a compromise which will terminate the long suit between the Bowler heirs and the Kentucky Central Company for the possession of the old Covington & Lexington road.

Cairo & Vincennes.

The receivers, Messrs. H. L. Morrill and A. B. Safford, took formal possession of the road May 20. They issued a circular stating their intention of operating the road with the strictest economy, and that all receipts in excess of current expenses will be applied to payment of amounts due for fuel, supplies and labor furnished since June 1, 1873.

Montclair.

The foreclosure sale has been again postponed, this time from May 23 until June 6.

Toronto, Grey & Bruce.

The city of Toronto has granted an additional bonus of $100,000 to this company, to aid in the extension of the line from Weston Junction to Toronto, nine miles. Trains now use the Grand Trunk track for that distance.

Pittsburgh, Washington & Baltimore.

This company has presented a memorial to the city of Baltimore representing that the company is unable to pay the arrearages of interest now due or the interest accruing July next on the second-mortgage bonds held by the city. The City Council appointed a committee to confer with a committee of directors of the company.

Cuyahoga Valley.

The Chief Engineer, Mr. Dudley, reports the condition of the work as follows: The grading is nearly completed from Akron, O., to within 14 miles of Cleveland, while that part which remains can be performed in a short time. The trestle

work at the Old Forge in Akron is finished, and there is but slight labor to be performed on the small bridges between Akron and Canton. The arch under the Cleveland, Mt. Vernon & Columbus Railroad at Akron is being built, and the two skew arches, each measuring 116 feet in length, to be constructed in Akron will soon be commenced.

Northern, of Canada.

This company has chartered six vessels for its regular line from Collingwood, on Lake Huron, to Chicago. Three vessels are run on the Lake Ontario line, from Toronto to Kingston.

Pittsburgh, Cincinnati & St. Louis.

A second mortgage for $5,000,000 on the road and property of this company has been placed on record. The deed is dated April 1, 1873, and is to Josiah Bacon and Albert Hewson as trustees.

Oil Creek & Allegheny River.

A meeting of the holders of the consolidated bonds, the May coupons on which are unpaid, was held in Philadelphia recently, about $300,000 being represented. A committee, with J. J. Woodward as Chairman, was appointed to obtain all possible information as to the condition of the company and to report at a future meeting.

South Side, of Long Island.

The Receiver and Superintendent appointed by Judge Donahue in New York have been arrested by order of Judge Barnard in Brooklyn for interfering with the manager of the road, Geo. F. Carman.

In the foreclosure suit of Wyckoff and Jones, trustees, judgment of foreclosure has been entered in the Supreme Court in Brooklyn, and E. L. Burritt was appointed referee to ascertain the number of bonds outstanding which are secured by the mortgages.

North Wisconsin.

The work of locating the line to a point 40 miles northeast of Hudson, Wis., and 25 miles beyond New Richmond, the present terminus, has been completed. Grading has been commenced at Star Prairie.

Memphis & Little Rock.

Some 40 miles of this road, from the Mississippi opposite Memphis west to Madison, on the St. Francis River, is still under water. The amount of damage done to the road cannot be ascertained until the water falls, but it is probably large. Trains are run from Little Rock to Madison, whence a steamboat plies to Memphis.

Burlington & Missouri River.

The trustees of the land-grant mortgage advertise for sealed proposals for the sale to them for cash of $160,000 of the 7 per cent. land bonds of the company, agreeably to the provisions of the trust deed. Proposals were to be received at the Treasurer's office in Boston up to May 27.

Duxbury & Cohasset.

An extension of this road, which is itself an extension of the South Shore Branch of the Old Colony road, is nearly completed, the tracklaying being in progress. The extension is from the present terminus at South Duxbury, Mass., southwestward to the Old Colony's Plymouth line in Kingston.

Rhinebeck & Connecticut.

The track has been laid to Gallatinville, N. Y., about 29 miles northeast of Rhinebeck and some four miles beyond Mount Ross, the point reached last fall. A large force is at work on the line and work is being pushed forward.

Delaware, Lackawanna & Western.

The change of gauge to 6 feet on the Utica line has been completed, and the broad-gauge trains now run through to Utica and Richfield Springs. Trains resumed their regular trips May 23, four days having been occupied in the change.

Central Vermont.

At the annual meeting in St. Albans, Vt., May 19, the President stated that no report had been prepared, as a report would have to be submitted to the Court of Chancery July 1. A statement, however, was submitted, which showed the operations for the first six months of the company's management, ending January 1, 1874. The statement is as follows:

Earnings	$2,441,993 22
Operating expenses	1,710,028 04
Net earnings	$731,965 18
Rents paid:	
Rutland and Addison roads	$192,000 00
Vermont Valley	32,500 00
Ogdensburg & Lake Champlain	215,195 00
Vermont & Massachusetts	21,000 00
Total rents	$460,695 00
Extraordinary expenses	16,608 24
Interest on floating debt	82,894 08
Interest on funded debt	193,413 05
Total	$753,610 37
Estimated net loss on Northern Transportation Line	28,654 18
	$782,264 55
Total deficiency	$50,299 37

The inventory of the property turned over by the old trustees had been made and submitted to the court. The Vermont Central property amounted to $7,139,785.53, and that of the leased lines to $2,914,965.07, a total of $10,054,750.60. The balance sheet showed liabilities of $75,760.20 in addition to the capital stock of $2,000,000. The assets are $1,993,975.20; investments and expenditures, $81,785. The board had been endeavoring to devise some way of harmonizing the various interests combined in the receivership, but no definite conclusion had been reached. It was proposed to fund the various liens on the trust property into one, but this could not be done until the various interests concerned could be brought to agree.

Grand Rapids & Van Wert.

A company has been organized to build a narrow-gauge road from Van Wert, O., northeast to Grand Rapids, about 70 miles, there to connect with the proposed Toledo & Grand Rapids road.

Toledo & Grand Rapids.

A company has been organized to build a narrow-gauge railroad from Grand Rapids, O., northeast some 15 miles to Maumee City, where connection will be made with the Toledo & Maumee road. The corporators are D. W. H. Howard, John C. Lee, T. M. Cook, Geo. W. Reynolds, C. H. Coy, Geo. Laskey, Geo. F. Hinsdale and S. S. Laskey.

Toledo & Maumee.

Grading on this narrow-gauge line from Toledo, O., southwest to Maumee City, is progressing, and a contract has been made for the iron. It is intended to have the road completed by July.

Chester & Media.

Surveys are being made for a road from Chester, Pa., northwest to Media, which is to be built on the one-rail system. The trains will run on a single wooden rail of a triangular section. The distance is about six miles.

CIVIL ENGINEERS' CLUB OF THE NORTHWEST.

Concerning the Cost of Transportation on Railroads.

[A paper read before the Civil Engineers' Club of the Northwest, May 9, 1874, by L. P. Morehouse.]

I am aware that many of those present this evening are familiar with the tenor of statistics like those which form the basis of this paper, but some particulars have not been generally made prominent, and to these I would call your particular attention.

Isolated facts, in themselves insignificant, are sometimes the guide-posts which point to the discovery of important principles. The business of transportation has hardly yet attained the position of an exact science, and, indeed, from the crude theories and contradictory statements so frequently met with in the discussion of the matter, it would seem that the very foundations which underlie the whole subject are not well established, or, at least, are not universally acknowledged. The object of this paper is to bring more clearly to view two or three of the facts that may be called foundation stones. I have no particular theories to maintain, and whatever opinions I may submit are presented with the special object of drawing out the views of others upon the same subjects.

One of the most important questions involved is in relation to the reasonableness of rates, and inquiry should be made to ascertain, if possible, what principles should govern in the establishment of charges for transportation. It is evident that the cost of performing any work, the actual outlay of money incurred, is one very important element in determining what should be the amount received by the performer from the party for whose benefit the work is done, and our first inquiry will be concerning the cost of doing the business which railroads perform.

If we ask what is the cost of transportation on railroads, we may be reminded that, according to statistics, the average expense of running a train one mile, on all the railroads of Ohio, Pennsylvania, Illinois, New York and Massachusetts, for the year 1872, was one dollar. But a glance at the figures shows that this varied from 85 cents on the Ohio roads to 131 cents on the Massachusetts roads; and, upon examination, we find that this latter amount represents an average of amounts varying from 99 to 178 cents.

While, therefore, we accept the sum of one dollar as the average for the five States named, we see at once that it may be unfair to take that sum as the cost for any one of the above-mentioned States, and, probably, much more so for application to any particular road. At the outset, then, we must acknowledge that the law of averages is limited in its application.

As the greatest interest in this matter appears to be felt in the Western States, whose prosperity depends so largely upon the cheapness with which their products can be transported to the Eastern market, it is desirable that we endeavor to ascertain what is the cost of transportation on Western roads. This field of investigation is, however, so vast that a paper like this can only touch upon its borders or follow one of the many roads leading through it.

It is a well known fact that the expenses of a railroad, or of any business, for a single year, may not show fairly the reasonable and proper average for a term of years. If large and extraordinary expenditures are made in one year, those for the next year may be much less than the average, and thus a great disproportion may exist in these two years. Nor is it safe to take the average of a number of roads for one year; for, in times of great prosperity all are enabled to spend freely, while in a season of great business depression, all alike lose in their profits and are forced to a rigid economy.

It is more reliable to take the statistics of a single representative road for a term of years and draw our conclusions from them.

The Illinois Central Railroad may, perhaps, be termed such a road, extending over the length and breadth of two States, its business and earnings less than those of some other roads, but much more than the average of all. From the published reports of that road, I find that for the last eight years the average length of road operated has been 982 miles, and the expense per train mile 94 cents.

We might at first sight conclude that here we had a fair average; but a moment's consideration will show that we have not reached a point where we can state the cost of any particular portion of the business. In the amount given above we have the average for all trains, passenger, freight, switching and construction, while the expense due to any one of these would vary much from that due to another.

It is desirable, also, to ascertain what part of the whole expense is due to the actual transportation, or dependent on movement of trains, and what part is due to the general operation of the road. Under the former, which I would term the *direct* expense, would be classed the expenses for the maintenance and service of engines and cars, the wages paid to trainmen, and the like. The latter, *indirect* expenses, would include repairs of fences and buildings, salaries of officers, agents and station laborers, and all expenses that bear no direct relation to actual transportation.

For the present we will confine our attention to the freight business, and try to ascertain its cost.

From the reports I find that the direct expense of the freight business for train expenses is $10,823,162.10; this being for train service, fuel, oil, waste and supplies, and repairs of engines and cars. The item of "cleaning engines" is not included.

The total freight-train mileage is 24,346,440 miles, so the expense per mile due to train service would be 44.45 cents.

The expense for maintenance of way should be divided between the passenger and freight business in proportion to the damage done by each. This is in proportion to the weight and speed of trains. The weight of freight trains is about twice that of passenger trains, and the speed about one-third less. A freight train of the same weight as a passenger train would do two-thirds as much damage to track, and one of twice the weight one-third more. The passenger-train mileage therefore represents, so far as maintenance of way is concerned, a freight-train mileage of three-fourths that amount. Switching trains may be considered as representing one-third of freight-trains, and construction and fuel trains may be taken as equivalent to freight trains.

For the eight years the expense for maintenance of way per mile run, of all trains, is 25.36 cents.

	Miles.
The mileage of freight trains is	24,346,440
" passenger trains	10,154,187
" switching trains	4,850,252
" other trains	872,759
Total	40,223,838

Reducing passenger and switching trains to their equivalent mileage, we have:

	Miles.
Three-fourths of passenger mileage	7,612,790
One-third of switching	1,616,751
Freight	24,346,440
Other	872,759

Making a total mileage, representing freight trains, of 34,448,740

The cost per mile, on this basis, would be 29.61 cents, instead of 25.36 cents, as found for all trains.

It is not, however, proper to take the whole of this expense as due to the movement of trains. The items which make up this amount are partly due to the natural action of the elements in causing the destruction of the road-bed, ties, bridges, etc.

I would divide them thus:

Renewals of rails all due to train movements, direct, 25 per cent.

Joints, spikes, making frogs and switches, direct, 7 per cent

Ties, divided equally, indirect, 6 per cent.; direct, 6 per cent.

Labor on track and track watchmen. The division of this amount varies according to character of road-bed, etc. In this case I would say: indirect, 21 per cent.; direct, 21 per cent.

Repairs of bridges and bridge watchmen, indirect, 8 per per cent.; direct, 4 per cent.

Other items, say, indirect, 1 per cent.; direct, 1 per cent.

The total percentage being, indirect, 36, and direct 64, for the division of expenses for the maintenance of way.

Instead of 29.61 cents, we should take 64 per cent. of that amount, or 18.95 cents, for the direct expense due from maintenance of way for a train, of any character, equal in speed tons to the average freight train.

The amount 29.61 cents does not include the whole sum chargeable to the freight business, for we have included the mileage of trains producing no revenue. The proper amount is obtained by considering only the mileage of trains producing revenue. Upon this basis we have 31.92 cents from maintenance of way, including direct expense, 18.95 cents, and indirect, 12.97 cents.

So far as we can ascertain the direct transportation expenses are: For train service, 44.45 cents; and for maintenance of way, 18.95 cents—making a total, for moving a freight train one mile, 63.40 cents.

There is no absolute rule by which the indirect expenses can be divided exactly between the freight and passenger business. We will assume that they should be divided in the same proportion as the direct expenses for train service: 73 per cent. to freight and 27 per cent. to passenger business.

The total expenses are:

For train service	37 per cent.
For maintenance of way	25 per cent.
Other expenses	29 per cent.
And taxes	9 per cent.

The amount of taxes is exceptionally large, this company having to pay a charter tax of 7 per cent. of the gross earnings on its road in Illinois.

Taking 73 per cent. of the undivided items and dividing by the freight-train mileage, I find 45.47 cents due to the indirect expenses.

The cost per freight-train mile will then be:

Direct	63.40 cents.
Indirect, maintenance of way	12.97 cents.
Indirect, undivided	45.47 cents.
Total	121.84 cents.

Instead, therefore, of a train-mile expense of 94 cents, as first found, we see that for freight trains it is about 122 cents, and that the indirect expense is only a little more than one-half this amount.

The expense is due to a business of 232,659,672 tons carried one mile, and an average haul of 142 miles. The earnings are 186 cents per mile.

In relation to the proper division, generally, of the total expenses between freight and passenger business, there is room for much diversity of opinion. By the preceding analysis we have found that 73 per cent. of train expenses and 76 per cent. of road expenses are properly due to freight, and we have assumed 75 per cent. of the balance as a proper amount, making a general average of a little more than 74 per cent. of the total expenses.

Had we assumed that the division should be in the same proportion as the freight and passenger earnings, we should have had 72 per cent., and if we had divided in proportion to the absolute mileage of freight and passenger trains, we should have had 70 per cent. Taking the mileage of passenger trains reduced to our freight-train basis would give 76 per cent.

Having found the expense per train mile, we proceed to ascertain the cost per ton. The average weight of train is about 340 tons, and the load 85⅓ tons, including 8⅓ tons of company's materials, so that the paying freight is 77 tons.

This large proportion of dead to paying weight is due to the fact that for local business it is impossible to obtain full loads for the whole distance a car is hauled, and to the necessity of sending cars back empty after having run full in one direction.